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The Official Agreement of the Arbitration Board—Corrected Copy.

In the "American Machinist," No. 22, there appeared what purported to be a copy of the resolutions of the Joint Board of Arbitration of the National Metal Trades' Association and the International Association of Machinists. Reports have reached us from various quarters that we are being severely criticised for the omission of an important paragraph relative to the employment of union and non-union workmen. We have been unable to understand these criticisms, as we did not cross out any such paragraph.

We are now in receipt of a pamphlet copy of the resolutions, put out by the National Metal Trades' Association, and on comparing it with our article we find in the pamphlet such a paragraph, which does not appear in the article. As we keep all manuscript on file for a definite length of time, we have turned to that from which our article was printed, and, although this manuscript was supplied from the office of the secretary of the National Metal Trades' Association, the said paragraph does not appear in it.

The importance of the subject requires that the action taken be placed in the possession of our readers, and to this end we republish below the full text of the resolutions as they appear in the above mentioned pamphlet, and at the same time we make the above statement to set ourselves right in the matter. The paragraphs which were omitted from the manuscript supplied to us are given in italics. As stated above, this manuscript is on file in this office, and may be consulted by anyone who desires to see it.

We may add that the same omissions occur in the resolutions as printed in the issue of the "Iron Age" for May 24. The whole matter, no doubt, resolves itself into a clerical error in the office of the Secretary of the National Metal Trades' Association.

The resolutions which appear under the heading Paterson were omitted by ourselves from the article of our issue No. 22. The advance in wages there is chiefly a matter of local interest, and the remaining resolutions will be seen to be a repetition of what appears earlier in the document.

True Copy of the Agreement as entered into between the National Metal Trades' Association and the International Association of Machinists at New York, May 18, 1900.

JOINT AGREEMENT.

At a meeting of the Joint Board of Arbitration of the National Metal Trades' Association and the International Association of Machinists, appointed under the Chicago agreement of March 17, 1900, signed March 31, 1900, held at the Murray Hill Hotel, New York city, May 10 to 18, 1900, the following resolutions were adopted and agreements entered into, to take effect from this date:

Resolved, That the strikes be declared off in the factories of the members of the National Metal Trades' Association in the cities of Cleveland and Paterson, the National Metal Trades' Association members of this board to wire the members of their association in these two cities to meet a committee, from each shop, of their former employees to arrange for the return of as many men as their present necessities require; and that subsequent requirements of men shall be filled from their former employees whom they may not be able to reinstate at the present time.

The intent of this last clause is, that if, within the next six months, former employees make application for reinstatement they shall be reinstated, provided there are vacancies for them.

Where strikes exist in these cities in firms other than the members of the National Metal Trades' Association, who will agree to the settlement herein entered into after the same has been adjusted by this joint body, such strikes shall be declared off also.

WHEREAS, Doubts have been expressed by members of this board, representing both parties to this conference, as to the ability of their respective organizations to control their members; now, therefore, be it

Resolved, That the members of this board pledge themselves each to the other that in case of the refusal of any member of the respective organizations represented to observe and carry out in an honorable manner the findings and decisions of this board in regard to strikes and lockouts, based upon a fair, just and liberal interpretation as to what is known as the Chicago agreement, we will report such members to our respective organizations for discipline, suspension or expulsion, as the merits of the case may justify.

MACHINIST.

A machinist is classified as a competent general workman, competent floor hand, competent lathe hand, competent vise hand, competent planer hand, competent shaper hand, competent milling machine hand, competent slotting machine hand, competent die sinker, competent boring mill hand, competent tool maker, and competent linotype hand. To be considered a competent hand in either class he shall be able to take any piece of work pertaining to his class, with the drawings or blueprints, and prosecute the work to successful completion within a reasonable time. He shall also have served a regular apprenticeship or have worked at the trade four years.

It is understood that the question of competency is to be determined by the employers. Since the employers are responsible for the work turned out by their workmen, they shall, therefore, have full discretion to designate the men they consider competent to perform the work, and to determine the conditions under which it shall be prosecuted.

This last paragraph does not in any way

abridge or destroy the right of appeal from any apparent or alleged unjust decision rendered by an employer of labor, or his representative, in conformity with the powers vested in him by this paragraph.

OVERTIME.

All overtime up to 10 o'clock P. M. shall be paid for at the rate of not less than time and one-quarter time, and all overtime from 10 P. M. until 12 midnight shall be paid for at the rate of time and one-half time, and that after 12 o'clock and legal holidays and Sundays be paid for at a rate of not less than double time.

In cases of emergencies, where shop machinery breaks or runs down, and it is absolutely necessary to repair the same so that the factory can run on Monday, this time shall be paid for at a rate of time and one-half time. The repairs above referred to apply only to the machinery of the employer.

The foregoing rates not to interfere in any way with existing conditions; that is, where a higher rate than the above is paid now, no reduction will take place.

Such rates for overtime shall not apply to men regularly employed on night gangs.

APPRENTICES.

There may be one apprentice for the shop, and in addition not more than one apprentice to every five machinists. It is understood that in shops where the ratio is more than the above that no change shall take place until the ratio has reduced itself to the proper number, by lapse or by the expiration of existing contracts.

EMPLOYMENT AND HOURS.

No discrimination shall be made against union men, and every workman shall be free to belong to a trade union should he see fit. Every employer shall be free to employ any man, whether he belong or not to a trade union. Every workman who elects to work in a shop will be required to work peacably and harmoniously with all fellow employees, whether he or they belong to a trade union or not. He shall also be free to leave such employment, but no collective action shall be taken until any matter in dispute has been dealt with under the provisions for avoiding disputes as per the Chicago agreement, dated March 17, 1900, signed March 31, 1900. The National Metal Trades' Association does not advise its members to object to union workmen or give preference to non-union workmen.

Fifty-seven hours shall constitute a week's work from and after six months from the date of the final adoption of a joint agreement, and fifty-four hours shall constitute a week's work from and after twelve months from the date of the final adoption of a joint agreement. The hours to be divided as will best suit the convenience of the employer.

In consideration of this concession in working hours, the International Association of Machinists will place no restrictions upon the management or production of the shop, and will give a fair day's work for a fair day's wage.

NOTE—This not to interfere in any way with shops where a less number of hours per week is already in operation.

PATERSON.

WHEREAS, It is the sense of this board, based upon the evidence placed before it, that the strike at Paterson was due to a misunderstanding as to the intent of the manufacturers regarding an advance in wages; and

WHEREAS, the members of the National Metal Trades' Association in Paterson show that since the uniform advance in wages of 10 per cent. was requested, they have advanced their machinists to an average amount equal to about 7 per cent.; now be it

Resolved, that the decision of this board is that a 10 per cent. increase in wages be granted in Paterson over and above the rate prevailing December 19, 1899, at the time the request was made for the 10 per cent. increase in wages. This to apply only to the shops in which the strikes occurred that were members of the National Metal Trades' Association.

Resolved, That the members of the National Metal Trades' Association be notified that this arbitration board recommends that if they desire to add to their shop rules any portion of the resolution relating to the employment and hours, that they shall add only the following:

"Fifty-seven hours shall constitute a week's work from and after six months from the date of the final adoption of a joint agreement, and fifty-four hours shall constitute a week's work from and after twelve months from the date of the final adoption of a joint agreement. The hours to be divided as will best suit the convenience of the employer."

As regards overtime, the following may be posted:

"All overtime up to 10 o'clock P. M. shall be paid for at a rate not less than time and one-quarter time, and all overtime from 10 P. M. until 12 midnight shall be paid for at a rate of time and one-half, and after 12 o'clock and legal holidays and Sundays shall be paid for at a rate of not less than double time."

"In cases of emergencies, where shop machinery breaks or runs down, and it is absolutely necessary to repair the same so that the factory can run on Monday, this time shall be paid for at a rate of time and one-half time. The repairs above referred to to apply only to the machinery of the employer."

"The foregoing rates not to interfere in any way with existing conditions; that is, where a higher rate than the above is paid now no reduction shall take place."

"Such rates for overtime shall not apply to men regularly employed on night gangs."

Resolved, That the resolutions and agreements heretofore adopted by this board be now approved as a whole, to take effect from this date.

For and on behalf of the National Metal Trades' Association.

(Signed) D. MCLAREN,
President.
(Signed) EDWIN REYNOLDS,
(Signed) WALTER L. PIERCE,

For and on behalf of the International Association of Machinists.

(Signed) JAS. O'CONNELL,
President,
(Signed) D. DOUGLAS WILSON,
(Signed) HUGH DORAN.
Joint Board of Arbitration.

Dated New York, May 18, 1900.

Personal.

Benton Orbison, for the past five years superintendent of the Twelfth street, Chicago, works of Fraser & Chalmers, has accepted a position with the American Steel Casting Company as general superintendent of their Alliance (Ohio) plant.

Technical Publications.

"Gas Engine Design." By E. J. Stoddard. Thirty-one 11x9-inch pages.

This pamphlet is gratuitously distributed by Parker & Burton, Detroit, Mich. It gives valuable information, with formulas and diagrams, relating to all of the various details of gas engine design. It is not easy to suggest how the work of the author could have been better done in any respect, and all who have to do with gas or oil engines should be glad to obtain the book, and none can well fail to appreciate it.

"Preparing for Indication: Practical Hints, the Result of Thirty Years' Experience with the Steam Engine Indicator." By Robert Grimshaw, M. E. Second edition. Profusely illustrated. New York, Practical Publishing Company. 56 pages, 5¾x3¾ inches; 60 cuts. Price, $1.

The thirty years' experience embodied in the book tells the reader how to pipe an indicator to a cylinder, and how to get a move on the drum, if the engine to be indicated is of the kind described in the book. It does not attempt to convey any other information.

The eighth annual meeting of the Society for the Promotion of Engineering Education will be held July 2, 3 and 4, 1900, at Columbia University, New York City. Among the more practical topics in the many papers to be presented are "Business Methods in Engineering Teaching," by Arthur L. Rice; "The Relations of the Technical School to the Manufacturer," by Walter B. Snow; "What Should be the Characteristic Features of a Course in Mathematics for Engineering Students?" by Arthur E. Haynes; "The Possibilities of Correspondence Instruction," by George A. Goodenough; "Operating Work as a Feature of Electric Laboratory Training," by William S. Aldrich.

Commercial Review.

NEW YORK, SATURDAY EVENING,

June 23, 1900.

MACHINE TOOLS AND OTHER MACHINERY.

The trend of business in the mechanical lines is unmistakably toward quietness, and to this machine tools are no exception. Summer dullness is an old friend, who has returned after a two or three years' absence. But in mentioning this quietness important reservations have to be made. One is that it has hardly yet begun to pinch, except psychologically, for enough old orders remain on manufacturers' books to keep them busy. Furthermore, there are signs of almost a revival in some quarters of Liberty street. The two largest houses there located are both understood to have discovered a better business in the last few weeks than somewhat earlier. Another local selling house is feeling very well satisfied, and in the line of milling machines has taken a larger volume of orders this month than last.

Values of machine tools are not exactly firm, and if one is on the search for weak spots he can find them. But it may be stated pretty confidently that leading manufacturers generally have made no official reduction, and perhaps the majority of standard makers would resist any ordinary inducement to yield concessions.

Regarding the proposed deal for control of the Pratt & Whitney Company by the Niles-Bement-Pond Company, or its representatives, inquiry was made to-day at the Niles-Bement-Pond Company's office, but no confirmation of the closing of the transaction was obtainable. From various sources, however, we have heard sufficient about the matter to give basis for a judgment of the progress of the deal and the form which it is taking. That an understanding has been arrived at, according to report, seems very likely, though it will probably be some little time before a formal ratification can be given. A majority in value of the stockholders of the Pratt & Whitney Company is said to have given their consent to the arrangement, and indeed it is stated that all yet approached have readily acquiesced. The method by which the Niles-Bement-Pond interests would acquire control is not the mere buying out of a majority of Pratt & Whitney stock, but one which may involve a reorganization of the latter company. It will therefore be necessary to call a meeting of stockholders, or to reach them by circular before the formalities are completed. It is believed that the Pratt & Whitney Company will retain its individuality under the Niles-Bement-Pond Company to about the same degree that the constituent companies in the latter do now.

The following is one account given of the financial program, which may be somewhere near the truth: The preferred stockholders of the Pratt & Whitney Company —$1,750,000 in value outstanding—are to receive 70 per cent. of their holdings in a new 6 per cent. stock, which will entitle to first preference under Pratt & Whitney earnings, the deficiency, if any, to be made up by second preference under Niles-Bement-Pond earnings. The remaining 30 percent. will be exchanged for common stock, and with the outstanding $1,000,000 common stock of the Pratt & Whitney Company purchased by the Niles-Bement-Pond Company at $10 per share.

There is some difficulty experienced even at this time in meeting with satisfactory promptitude the demand for gear cutters, universal grinders and horizontal boring and drilling machines. A large manufacturing concern which makes the two former is unable to catch up with its orders for them, although in other lines, such as milling machines, it has been gaining on the work. A dealer recently was obliged to put in a second-hand gear cutter in filling an order, to bridge over the time till he could get a new one, and he would be glad to find a second-hand boring and drilling machine, too.

A quietness in railroad orders noticed in one office is accounted for on the novel ground that the railroads do not make extensive improvements while they are very much rushed with traffic. They then add a few tools as required; while in duller times they look over their equipment to see what important extensions ought to be made. But they have steadily been adding a good deal to their shops in the last year. A prominent Eastern railroad has lately asked estimates on sixty or seventy wood-working machines, to be used in equipping a forthcoming car shop. It is thought that the road may contemplate the erection of other shops requiring iron-working tools.

The writer was in Newark this week, and found that while the machine tool business coming to that place was not so heavy as it had been, both of the machine tool manufacturers there located seemed to be well supplied with orders, were running with full complements of men, and had made no reduction in prices.

The Newark Machine Tool Works have recently sold two more large horizontal boring machines—4-inch bar—to the Westinghouse interests at Pittsburgh, who had previously purchased some fourteen of them. Three such machines with 3 to 4-inch bar were sold lately to the Crocker-Wheeler Electric Company.

Parties who have returned from the conventions of the Railway Master Mechanics' and Master Car Builders' Associations at Saratoga this week report that the business sentiments prevailing there were very cheerful. The conventions, by the bye, were a success from every point of view. The exhibits were well chosen and well received.

Niagara Machine Tool Company, Buffalo, N. Y., reports no appreciable falling off in the demand for its metal working tools. It is also experiencing a steady call from Europe.

A man who has recently been traveling in Maine, New Hampshire, Massachusetts and Connecticut in the interest of a specialty related to shafting, says that business conditions in the shops of those States seem to be slackening up somewhat, but that people are still getting along fairly well. Speaking of paper manufacture there, he says that in the newspaper line it is quite active, because of the large fires in Ottawa and England, which have helped the export demand. Writing paper manufacture is not equally active.

The Ames Iron Works are shipping about twenty boilers of 50 to 100 horsepower each for the Chinese Eastern Railroad, to drive air compressors of the Ingersoll-Sergeant Drill Company. Two 50 horse-power Westinghouse steam engines have lately been ordered for this road.

Some recent sales of Westinghouse gas engines were: To the New York Electric Vehicle Transportation Company an 85 horse-power three-cylinder engine for charging storage batteries; to the Mankato (Minn.) Gas & Electric Company an 85 and a 50 horse-power engine; to the Oshkosh(Wis.) Gas Light Company two 50 horse-power engines. Among various orders for mechanical stokers one was from the Pressed Steel Car Company, Pittsburgh, for two 250 horse-power ones.

The Westinghouse Machine Company is getting as many orders for its products as hitherto, although inquiry does not seem to be quite so active.

A Spanish-American export house reports a good, steady trade with Mexico and with South America, particularly on the Eastern coast. There is a large amount of electric work in the Argentine Republic. They remark that a great proportion of the Mexican trade is not apparent in New York, since it goes from Chicago and other Western points by land. From the Gulf ports also extensive shipments are made; for instance, quantities of rails have been sent from Mobile.

Mr. Rodney Thayer, one of the Thayers who manage the New York end of the Aultman & Taylor Company's business, has lately returned from a Mexican trip. He speaks of activity prevailing in that country, particularly in copper mining. Locations for new copper mines are being sought for there eagerly. Boilers of a small size are in good demand. He did not notice in the country a great deal of work of general industrial character that called for boilers.

The Electric Vehicle Company, a Whitney-Widener-Elkins interest, filed articles of incorporation in Trenton, June 21, increasing its capital stock from $12,000,000 to $18,000,000.

CINCINNATI REPORT.

Local conditions in the machinery market may be said to be somewhat off in point of demand at least. The larger

manufacturers of machine tools concede there is a slight falling off in orders, while the makers of smaller tools are less conservative. These acknowledge there has been considerable of a drop within the last fortnight. One of the large machine-tool concerns through its secretary and treasurer reports enough business booked to carry it through the next two or three months, by which time, in his opinion, a change for the better will come. The same concern, which does a large business both in export and domestic orders reports a number of good inquiries in both departments for delivery in the fall. Taking it all in all, the consensus of opinion suggests the thought that good normal business may be expected for some time to come.

The recent labor disturbances have not handicapped the larger concerns materially, although they confess that the supply of first-class machinists does not keep pace with the demand. Said an official of one of these concerns, "There has been no time in the last year or two when we could not have put on more machinists had they been available." Mr. W. A. Winkelman, of the Cincinnati Radial Drill Company, advances what is probably a logical reason for the midsummer lull especially manifest in a foreign way. Mr. Winkelman feels that the great majority of buyers, especially foreigners, are delaying their orders, awaiting their inspection of the machinery at the Paris Exposition to determine the latest types and become more familiar with the condition generally. This firm sent out eleven machines for Paris last week.

The E. A. Kinsey Company reports everything quiet in all departments with the principal demand for larger and more costly tools. Smaller lines are not having much activity. This firm will probably furnish much of the material to be used in the extension and enlargement of the Mill Creek Valley street railway lines, connecting Cincinnati and Hamilton. The street railway supply department of this concern reports the situation very fair indeed.

There is considerable interest manifested in the institution by the Lunkenheimer Company of a new industry here, the manufacture of automobiles. This is an enterprise of the iron-fitting and valve-manufacturing department. The plans for the building and the operations of the new company are rather extensive. The factory itself will be one of the largest in the city, and a large foundry for making the castings to be used will be another feature of the plant.

George Oliver Bradley, a young mechanical engineer and manager of the Bradley Engineering & Machinery Company, of Spokane, Wash., was a large purchaser of engines during the week. They were secured for the great Republic Gold Mine in Washington, to be used in reducing the ore by cyanide process. There is a good demand, by the way, for mining machinery of this character, and the prospects are that this particular line will show an interesting condition during the otherwise dull month.

L. Sharpe, Jr., and J. H. Drury, of Providence, Rhode Island, from one of the largest machine tool manufacturing concerns in the country, have been in Cincinnati investigating the local producing market.

E. Oliva and S. O. Kamoto, representing a large Japanese syndicate in Tokyo, have been looking about among the manufacturers of electrical machinery during the week. They placed some good orders. One of the electric manufacturing companies here reports the shipment of two power machines to Havana, another to one of the South American countries, and still another to Russia. The demand for electrical generating apparatus is generally good with all the local concerns dealing in that type of machinery.

The American Tool Works Company has recently taken large orders for iron-working machinery for Germany, Sweden, Italy and Mexico.

CHICAGO MACHINERY MARKET.

If there were no invasion of electrical power into new fields, the present state of trade would beyond question be described as dull. As it is, some makers of motors and dynamos impute that expression to the face of business. Others say that orders keep coming in with little variation from the degree of activity seen for months past. In no direction does there seem to be anything approaching a collapse in the demand, save in cities that are burdened with strikes involving the building trades. Sales of electrical machinery in Chicago would certainly, from all accounts, be trebly greater, were there restored between contractors and mechanics the broken business relationship. Those salesmen who make it their business to mix up among builders and contractors, say there is a large amount of work holding back for the longed-for settlement. In some other Western cities trade is similarly affected by these unfortunate conditions. But, notwithstanding, electrical machinery producers are making some satisfactory sales, when aggregates are considered.

The representative of a large contractor of electrical work remarks that the outlook for interurban railways is very bright. Not so long ago, he said, projectors of electrical lines had to go to New York or to Boston to finance their plans, but at present there is a disposition in Chicago to take care of these enterprises. Capitalists, he said, were beginning to regard these investments as comparatively safe. There are a number of projects of this nature under way; one of which, soon to be closed, is for a 30-mile road extending out from Columbus, Ohio.

There continues a brisk demand for electrical machinery for mining operations. There is continued activity in this branch of industry throughout the West, and, while orders for electrical power are usually small, they are numerous, and the aggregate grows steadily. At Chicago many motors are being put into small shops which, during the daytime, obtain power from the building. Not infrequently these shops are obliged to work overtime, if facilities permit, in order to obtain which they are using electrical power from outside currents.

Municipal work is fairly active. Potter & Benson, Chicago, have asked bids for a city electrical plant at Shelby, Ohio, of about 150 horse-power, for lighting purposes. The Sprague Electric Company has sold an electrical power outfit of about 150 horse-power to the Chamberlain Medicine Company, Des Moines, Ia. The Crocker-Wheeler Company has sold a 360 kilowatt generator and thirty-two motors for the Anglo-American Provision Company, Chicago. The General Electric Company has sold two 150 kilowatt generators to the Toledo Bridge Company, of Toledo, Ohio. The Eddy Electric Manufacturing Company reports an excellent demand for small motors for manufacturing purposes.

Quotations.

NEW YORK, Monday, June 25, 1900.

Iron—American Pig, tidewater delivery:—

Pennsylvania Irons:	
No. 1 X foundry	$18 50 @ $19 50
No. 2 X foundry	17 50 @ 18 50
No. 2 plain	16 50 @ 17 50
Alabama Irons:	
No. 1 foundry	21 00 @ 21 25
No. 2 foundry	20 00 @ 20 25
No. 3 foundry	19 00 @ 19 25
No. 1 soft	21 00 @ 21 25
No. 2 soft	20 00 @ 20 25
Foundry forge	17 75 @ 18 25

Bar Iron—Base sizes—The price on dock is 1.70 @ 1.75c. for good refined brands and 2.10 @ 2.20c. upward for same from store.

Tool Steel—Base sizes—Good standard quality, 7 @ 8c.; extra grades, 10 @ 14c.; special grades, 16c. and upward.

Machinery Steel—Base sizes—From store, 2.40 @ 2.50c.

Cold Rolled Steel Shafting—Base sizes—From store, 3½ @ 3¾c.

Copper—In carloads—Lake Superior ingot, 16¼c.; electrolytic and casting, 16 @ 16⅛c.

Pig Tin—In 5 and 10-ton lots, 31⅝ @ 31¾c.

Pig Lead—The American Smelting and Refining Company has advanced the price to 4⅛c., New York, for wholesale lots, and carloads are quotable at .02½ @ .05c. extra.

Spelter—Prime Western, 4.15 @ 4.25c., New York delivery.

Antimony—Hallett's, 9½c.; United States, 9⅜ @ 9½c.

Lard Oil—Prime City, 58c. in lots of one to five barrels.

More Early Milling Machines.

BY E. G. PARKHURST.

In a former paper, March 8, we dwelt on the origin of a machine devised in 1818, from which time until about 1822 we can trace little or no improvement. From about 1834 to 1836 the milling machine began to assume a position of importance in the manufacture of gun parts, and during the following ten years the art of milling had a slow though steady growth.

FIRST IMPROVEMENT.

The first radical improvement in the milling machine, that of having the spindle mounted in upright sliding journal boxes at each end of the head, through which passed the vertical adjusting screws, also the binding screws directly over the same and down through the tie caps, which extended the entire distance, or width, of each end of the head, thus supporting and strengthening the same, a device now in common use, is said to have originated at the works of Mr. Eli Whitney, at New Haven, Conn. It is more than probable that Mr. Whitney may have originated many other mechanical devices for machinery, as he in his time was one of Connecticut's foremost inventors, and one whose inventions have proved of lasting benefit to the world at large. As nearly as can be learned, each manufacturing company constructed their own machines as best suited to their (supposed) needs, and four or five were considered enough for roughing out (as that was all they were used for) parts for filers. We have the statistics from records of an establishment which in 1845 employed about one hundred hands. It was not until about 1849 or 1850 that the milling machine really came to the front, where it has since remained, as one of the principal labor saving machines in duplicating nearly all kinds of metal parts where cutting is required. Early in the fifties very many were in use, and the art had so advanced that mills could be *ganged* (shop term) together to cut almost any desired shape.

To show how much advance had been made we will relate a well-authenticated story. A tumbler for old-style gun locks, from its peculiar form, curved and with half and full-cock notches, was considered by gun makers a very costly part to machine. This exceedingly difficult feat of milling a tumbler into a receiving gage was successfully accomplished by one Mr. Gilbert A. Bush, and inasmuch as he, at that time, had a contract for making 10,000 tumblers, it brought him good money and also spread his fame far and wide as a king among mill makers. From that time on nearly all government inspectors of arms insisted on having such character of work, because of its being much more accurate and perfectly interchangeable.

SLABBING MACHINE.

Some time early in the forties there appeared a kind of milling machine, now obsolete, called a slabber. Who coined the name or devised the machine is not known. In general form of frame construction it resembled an iron planer, and it is presumed that the milling attachment

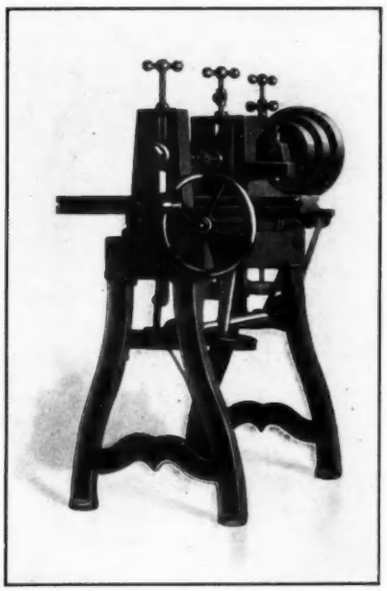


FIG. 1. THE HOWE MILLING MACHINE.

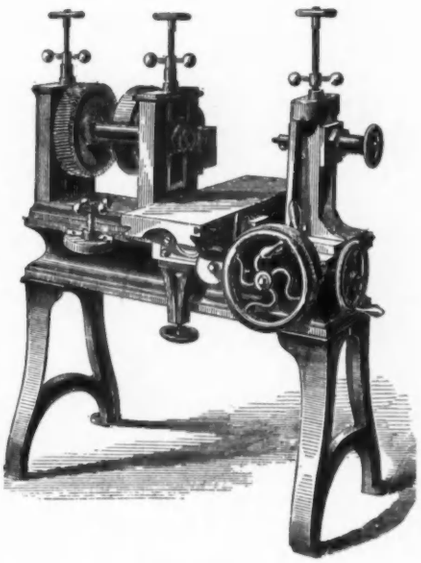


FIG. 2. THE M'FARLAND MILLING MACHINE.

was put upon a planer frame. To the uprights were attached a cross beam having journal boxes at the outer ends, in which was mounted a spindle having a belt-driven pulley at its outer end. The spindle was about 1½ inches diameter, and had a square thread about ¼ inch pitch cut the whole length between the journals, which were necked below the bottom of the screw thread, thus allowing the two hexagon nuts for securing at each end the mill (if such it could be called), having teeth cut about No. 12 diametral pitch, thus being a cross breed between a file and a cutter. Usually the said tool was made from wrought iron, and "box" or case hardened. The table or platen was tracked on V-shaped ways, and driven by rack and pinion, which in turn was driven by worm gearing and belt-driven worm. Little is the wonder the machine was short lived; it did not fill the requirement, even at that period, therefore little or nothing toward advancing the art of milling came from it.

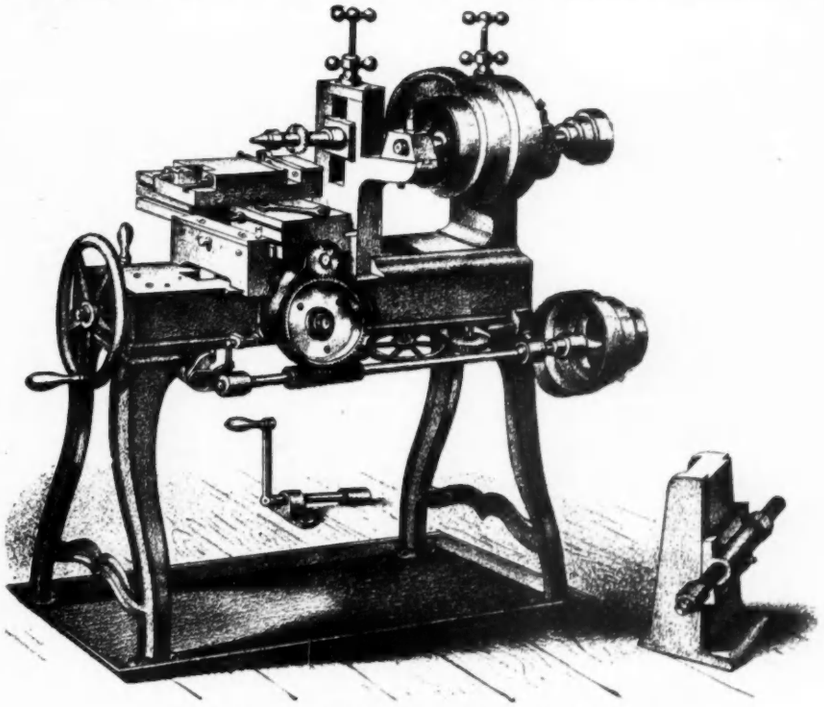


FIG. 3. THE LINCOLN MILLER—DESIGNED IN 1854.

About 1850 two of the savants mentioned in a former paper took a hand at

designing milling machinery, Mr. Fred W. Howe and Mr. R. F. Lawrence, and it is believed that both of the gentlemen made many improvements in the way of adjust-

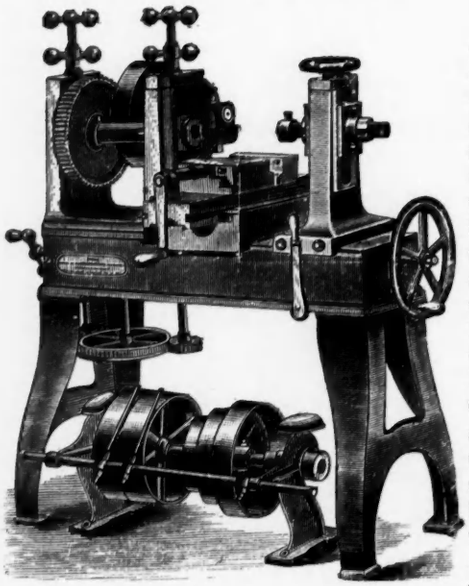


FIG. 4. THE LINCOLN MILLER AS MADE BY THE P. & W. CO.

ments and surety of action, or, in other words, made the machines in such manner that little brain power was required of their attendant, and it had become considered boys' business, and not for men. It was not, even in those days, an unusual matter to see one boy minding four or five, and more, according to the time consumed in taking the cuts. The photo of the Howe machine here shown, Fig. 1, has been obtained by considerable trouble.

It was also about this period that the Ames Manufacturing Company, of Chicopee, Mass., occupied about the first place in the United States as manufacturers of gun machinery. Many kinds were brought out, among which was a milling machine, Fig. 2, and a very fair copy of the Howe, only slight alterations made. It was supposed to have been designed by one Mr. C. McFarland, a very efficient mechanic. And his name should be mentioned as one who largely contributed to the art of machine making (particularly that of gun stocking).

THE PRATT MACHINE—LINCOLN MILLER.

From the first even to 1854 the method of feeding parts to be cut under a rotary mill was through the medium of a toothed pinion geared into a rack underneath the table of the machine. In 1854 another savant, Mr. F. A. Pratt, took a hand at designing, and brought out what is known as the Lincoln miller, Fig. 3, which embodied the invention of a screw feed, with quick hand return motion. Probably no other milling machine is as well known or has been so world-wide copied. Thousands are now in daily use, both in this and other countries. We would state that the Pratt & Whitney Company alone have turned out over 5,000, and now have many in process of construction. Fig. 4 is a cut of the machine as now made.

ROOT MACHINE.

In 1848 Mr. E. K. Root, one of the savants heretofore mentioned, was superintendent at Col. Colt's Armory, at Hartford, where he assembled many skilled mechanics, who, together with himself, from 1848 to 1861 created the most magnificent armory buildings and plant for the same ever known, and for many years it has been kept far in advance in the arts, they being self-containing so far as designing and executing their own plans for machinery required for their special wants. Even to this day the Colt P. F. A. Co., under the able management of Mr. John Hall and the superintendent, Mr. L. Grover, is in a most flourishing condition, and should one happen to pay a visit to the works he would find many up-to-date machines, also numerous old ones which bear the stamp of the master, among which is a milling machine designed about 1854. And they now have in process of construction fifty for their own use. We may add that little or no alteration has been made in general design, only added weight. Therefore, constant shop usage for the past forty-six years has demonstrated the fact that it is what it should be. And the Root machine came to stay.

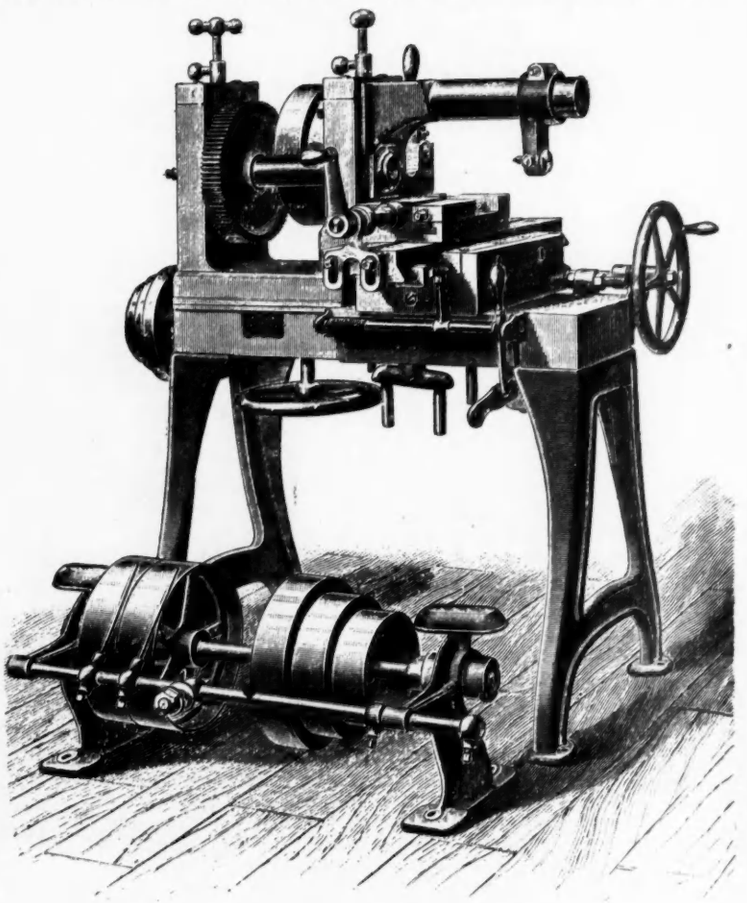


FIG. 5. THE ROOT MILLING MACHINE.

The distinctive feature of the machine, Fig. 5, is in the table, which is driven by a worm direct into a worm rack cut on the under side of the table. The head and spindle, also the gearing, differ little from the Lincoln and others of older dates. There are two appliances worthy of mention, that of having a yielding clutch and hand lever for operating the same to disengage the driving cone pulley so that the spindle may be stopped without having recourse to the overhead countershaft. Also an automatic knock-off, which instantly stops the machine, leaving the table in any desired part of its traverse. I am unable to trace the date when the last-mentioned was added, though undoubtedly it was many years ago.

In order that one may conceive something of an idea of how vast was the field occupied by the milling machine in the manufacture of gun parts during the period between 1861 and 1866, we would mention that hundreds of thousands of arms were turned out by the Government and private armories. What were known as the Springfield 50-caliber muzzle-loading rifles, the exact number of which I have no knowledge, but a low estimate would place the number nothing short of 1,000,000. This number added to the known number of breech-loaders, 397,056, making a total of 1,397,056, multiplied by the number of required mill cuts on each gun,

209, would give employment for a very great number of machines; therefore it is an impossibility to comprehend how the art must have advanced during the five years. It should also be noted that milling had become a prime factor in the manufacture of sewing machines, which at this time began to be a very large industry, and in fact the same absorbed after 1863 nearly all the milling machines which had been abandoned for military arms.

We are indebted to Mr. F. A. Pratt, of the Pratt & Whitney Company, for information concerning facts of date and data.

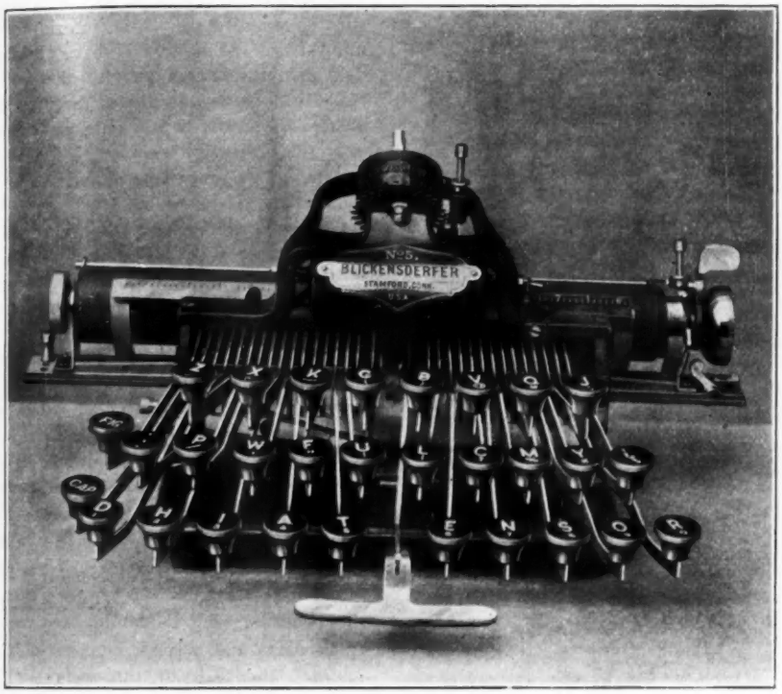


FIG. 1. THE BLICKENSDERFER TYPEWRITER.

A Typewriter Factory.

BY R. I. CLEGG.

There is nothing in the line of mechanism that has had, in my opinion, a more potent influence upon office work than the typewriter. It enables two hands to get to work where formerly but one could be employed. In connection with stenography it has vastly lightened and quickened the daily task of the business man. I have given more or less attention to typewriters, as a good share of my time has been taken up in the making of them. The subject is an attractive one to the mechanic. The lightness and delicacy with which the mechanism shall perform its duties, combined with the construction sufficiently robust to endure the handling of operators of all kinds, calls for a high-grade of workmanship in the building of the machines, as well as competence in the designers.

The machine here spoken of is of the "wheel" class, as opposed to the style known as the "type bar" machine. This is but a rough definition at the best, since there are machines having characteristics of both; but the idea of the "wheel" machine is to place the letters upon either a segment or the complete circumference of a cylinder, and by the suitable rotation of the latter, the type wheel, the letters are brought into exact position and then inked by a roller, as in the ordinary printing machine; or a thin ribbon, treated with some aniline dye, is interposed between the wheel and the sheet of paper, and the pressure upon the keys brings the required letter or figure into close contact with the paper.

It is not necessary to enlarge upon the means employed to bring the type wheel into position. Obviously in the building of work of this class, of an interchangeable character and of light weight, the press and the screw machine assert their usefulness. The several key levers are connected through the medium of cam surfaces which change the leverage as the moving type wheel acquires momentum. The notched blank, seen under the type wheel in Fig. 1, in moving towards the paper causes a rigid blade to enter the appropriate slot, locking the type wheel in exact alignment at the moment of printing, and preventing the possibility of a blurred impression. The rotation of the type wheel is the first result when pressing down the key lever, and lastly the printing wheel swings over, passing the ink roller, and thence on to the paper. These motions are not mechanically difficult to obtain, provided a really satisfactory type wheel is assured.

This wheel is the key to the whole thing and is one of the most original press jobs that has yet come my way. It is an ingenious adaptation of the hydraulic process of forming sheet metal hollow ware. I say an adaptation, because that is the nearest process to it of which I am aware, though very likely the scheme is entirely original with the inventor of the machine under consideration. The method employed reminded me of a kink familiar to workers in thin sheet metals used in the jewelry and allied industries, viz.: When a fluted or otherwise ornamental plunger fails to "bring up" all the design in the die, by reason of wear, etc., a small quantity

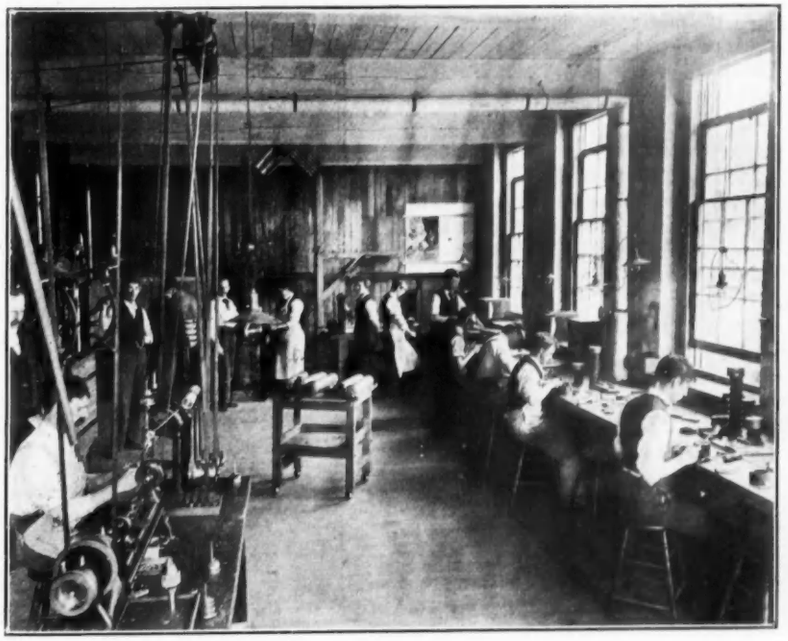


FIG. 2. THE WHEEL ROOM.

of water dropped into the cup-shaped blank will, when the press is brought into action, bring up the details in perfect relief. Instead of hydraulic pressure the inventor of the process employed at the Blickensderfer factory uses steam.

The wheel room is shown in Fig. 2, and the several operations in making a type wheel will be noted. In the first place, the wheel should be very light, as it is normally in a state of rest and the inertia of the wheel must be overcome by the fingers through the medium of the key levers for each letter or character printed. Necessarily, the lighter the wheel the greater the ease with which the inertia will be overcome. There is a limit to the lightening of the wheel, otherwise durability and strength must be discarded, and this is a vital question where the wheel is practically to be used continuously as a hammer. Here comes in the problem of pressing up, or casting, a hollow wheel (cylinder) of hard rubber, or some similar composition or of suitable metal, entirely closing the space at the top and the bottom of the wheel and the hub or sleeve by solid webs, with strengthening ribs.

At the outset a master wheel is turned up out of solid stock and cut around the periphery exactly like the desired type wheel. In the early days of the factory these steel blanks were cut or engraved by hand—a slow and expensive process, as a degree of accuracy not easily obtained was absolutely essential. Mr. Blickensderfer has since devised a special milling machine in which the design is copied by the workman, aided by an electrical device, and transferred to the wheel by a milling cutter. I have had no chance of testing the speed of the cutter, but am told that it rotates at over 18,000 turns per minute. From the finished master wheel are cast wedge-shaped dies or molds; the small ends of the wedges fit around the circumference of the master wheel, and their concave faces have the characters cast in, in intaglio, that are in relief on the wheel.

To make the type wheel the composition is rolled into thin and pliable sheets for easy working; the wedges are put together in proper order on a base plate having a stem to form the sleeve, or hub, of the future type wheel. The inside of the cavity formed by the wedges is then covered with the plastic compound in an even sheet, as is also the side of a cap plate which covers the upper part of the mold. A little water is then placed in the mold before the parts are clamped together; a number of molds are fastened firmly in position and heated to a sufficient temperature to turn the water into steam, thus forcing the composition into all the crevices in the mold, and after several hours' baking the clamps are removed and the mold separated without injury to the characters.

FIG. 3. ASSEMBLING DEPARTMENT C.

As it is necessary to put a small hole through the web at one end of the wheel for the turning pin, or "dog," a modification of the foregoing process has lately been introduced, viz.:To apply high-pressure steam directly to the interior of the mold from the boiler. I have, however, described the earlier process also because of its interesting and unique features. The system is, either way, quite an effective one; the finished wheels weigh less than a quarter of an ounce apiece, and are sold at a dollar.

On the movable bench in the center of Fig. 2 are seen several molds clamped in position; the workman in the left foreground is drilling the holes in the wheels for decreasing the weight, while to the right the molders are inserting the composition in the molds, etc.

The extensive establishment is naturally divided into numerous departments. Manufacturing departments A and B, as they are termed, both show the free use of light screw and milling machinery. Figs. 3 and 4 show the assembling departments C and D. The general use of the combined boxes, similar to a printer's case, on the benches, each containing the needful small parts and screws, etc., not only facilitates the task of the workman, but keeps the benches free from the litter occasionally noted in other shops.

The last department is as essential as any of the others; this is the inspection department. Here the machines are put through the trial trip, adjusted, approved or condemned, as the case may be; and anyone who has ever noted the minuteness of the error noticeable to the eye of the trained mechanic in the typewriter line will understand the delicate perception

FIG. 4. ASSEMBLING DEPARTMENT D.

requisite to the thoroughly expert inspector. As one reflects that this factory is not the largest of many devoted to this industry, there comes the difficulty of adequately estimating the figure that the modern typewriter cuts in the world at large.

More Experience with the Premium Plan.

The accompanying table presents a birdseye view of the workings of the premium plan, and may be considered a supplement to the similar exhibit published in our issue of March 9, 1899. It has been supplied, with great liberality, by a manufacturing corporation which has used both day work and piece work and has now definitely adopted the premium system as superior to either. For obvious reasons the name of the corporation cannot be given, but our readers will take our word for it that the name, if given, would be found in the front rank of progressive manufacturers. The nature of the work reported will be seen to be the manufacture of electrical machinery.

After recounting their experience with piece work, the parties who supply the table go on to say:

In the spring of 1899 several articles appeared in the "American Machinist" on the premium system and it was decided to try it. The conditions to be considered were as follows: Some plan must be found which, while being mutually beneficial to employer and employee, could not be run away with, thereby necessitating changes in the rates and the loss of the confidence of the men. It must be introduced gradually, and in such a way as to convince the workmen of its merits and fairness by actual trial. The whole shop system had just been reconstructed with new forms and very complete detail, and it was desirable to change this as little as possible. The variety of work to be handled was very extensive, especially in the machine shop, there being over 5,000 drawings, many of them having several different parts on the same drawing, with several different operations on each part. At the present time we have figured for premiums on something over 1,200 drawings, with an average of three operations on each drawing. The designs of the machines had all been changed within a year, so that our records were of little use for direct comparison in setting the time. The character of the work being unchanged, however, our records enabled us to estimate closely the time required for the various operations, and where the spaces in the column headed "Old Time Taken, Day Work," are vacant, it is to be understood that the time allowed was obtained by such estimates. These figures are close enough to satisfy us as a basis for premiums, and should satisfy your readers, especially when it is considered that most of the men in the shop were new men and entirely unfamiliar with the work. If the limits were set too close they would have no interest in the system, and it would fail at the start. If they were set too high, when the men became familiar with the work they would run away with it, and as it was of the utmost importance not to change the time once set, thereby losing the confidence of the men, great care must be used, not only in setting the time for

Name of Part.	Size.	Operation.	Number of Pieces on Premium Job.	Old Time Taken, Day Work.	Time Allowed on Premium.	Time Taken on Premium.	Old Wages per Day.	New Wages per Day.	Old Wages, Cost per Piece.	New Wages, Cost per Piece.	Highest Time Taken when on Premium Work.	Reason
	Inches.			Hours.	Hours.	Hours.					Hours.	
Commutator Nut		Bore, Tap and Turn.	6		6	3	$ 2.50	$ 3.33	$ .25	$ .17	8½	2 men.
" Ring	4¾	Bore and Turn.	4		9	4.5	2.25	2.95	.505	.43	8	Slower man.
" Sleeve & Nut.	5¼ x 5⅛	" " "	10		67.5	35.15	2.25	2.95	1.48	1.03	64	2 men.
Pole Faces	9 x 6 x 5	Assemble and File.	4		8	3.75	1.50	1.95	.30	.18	53 for 40	Same man when new at work.
Rocker Arm	7	Drill and Tap.	20		53.20	25	2.25	3.10	.58	.39	42⅓	2 men.
" "	18½	Shape Parting.	2		1.5	.5	.70	1.13	.053	.027	2½	Slow boy.
" "	18½	Bore and Face.	2		7	6	2.25	2.33	.79	.699	10	2 men.
Armature Coils	6	Winding.	375		37.45	23.45	1.50	1.80	5.65	4.27	2¼ for 15	Small number.
Field Coils	21	Hand Winding.	36	7 ea.	228	133	1.00	1.22	.70	.45		
Brush Yoke Rollers	3½	Bore, Turn and Cap.	30		60	21.15	2.25	3.60	.45	.26	35	Same man on 1st lot.
B. Y Roller Bush		" " " "	20		35	15	2.25	3.25	.44	.24	4 for 4	Same man on smaller number.
Bearing Bushing	1 13-16 x 8	Bore and Turn.	60		38	28	2.25	2.52	.14	.12	6 for 4	Man on smaller number.
" Pedestals	10	Planing Comp.	40 Set		35	23	2.25	2.65	1.20	1.15	33	2 men.
" "	10	Drill and Tap.	40 Set		50	31	2.25	2.71	.28	.21		
" Housing	16	Bore and Turn.	25		43.45	24.30	2.25	2.81	.39	.28	26 for 10	2 men (also 23 h. for 10 with 3 men).
Bearing Housing	6	Drilling.	10		9.15	6.45	1.75	1.97	.16	.13	12¼	2 men (1 the same).
" "	16	Bore and Face.	5	6	31.15	23	2.25	2.52	1.41	1.16	13 for 2	Same 2 men on 1st lot.
Armature	25	Fin. Bearing & Comm.	1		25	14	2.75	3.47	6.87	4.87	53 for 2	3 men.
"	13	" " "	2		10.15	6	2.75	3.40	1.41	1.02	36 for 6	2 men.
Yoke (2 halves)	16	Bore and Face.	2	30 ea.	52	35	2.50	2.90	7.50	5.08	25 for 1	Lost in set mill.
Yoke, lower half	16	Planing.	8		38	24.45	2.50	2.95	1.19	.91	15 for 30	2 men (small head planer)
Yoke	16	Bore and Scrib.	4		42	17	2.50	3.70	2.63	1.57	10 for 1	Setting up mill.
Steel Yokes	10	Drill in Jig.	7		21	14	1.75	2.05	.53	.41	5¾ for 2	22½c. man on 2.
Yoke (2 halves)	16	Drill and Tap.	2		21	15	2.25	2.55	2.36	1.92	37 for 1	2 men on 1 yoke interrupted 6 times.
Sub Bases		Planing.	15		45	39.30	2.50	2.62	.75	.689	50	4 men
Brush Yoke	38	Turn and Face.	10		85	57.45	2.50	2.90	2.13	1.67	10 for 1	1 to do.
" " Swivel		Turn and Chase.	10		22.45	10.30	2.25	3.10	.51	.33	28	2 men.
Armature Core	13	Assemble and File.	6		54	33.45	1.00	1.20	.90	.68	7.15 for 1	1 to do.
Arm. Front End Head	17	Bore and Face Comp.	10		32.30	15.30	2.25	3.07	.73	.48	30	3 men.
Arm. Spider & Comm Sleeve	25	Bore and Turn Comp.	8		148	96.15	2.50	2.86	4.62	3.44	100 for 6	2 men.
" " " "	16	" " " "	9	20 ea.	175	105	2.50	3.05	5.00	3.57	15.15 for 1	Same man on 1.
Armature	21	Wind Core and Build.	1		26.30	19.45	2.50	2.78	6.62	5.25	25.45	Same man on 1st 1 of lot of 10.
"	10	" " " "	1		11.15	7.30	1.75	1.99	1.92	1.49	9	2 of the fast men.
"	25	" " " "	1		23.45	17	2.50	2.83	6.08	4.80	22	Slower man.
"	13	" " " "	1	12.45	12.45	8	1.75	1.95	2.22	1.58	17.15	New man.
Controller, 60 h. p.		Assembling.	6	696	600	365	2.50	3.03	29.	18.65	165 for 2	Smaller number.
Armature	16	Fin. Bear. and Comm.	1	12	11	6.20	2.75	3.43	3.30	2.06	10	Another man same rate and equally familiar with work.
Armature	13	Fin. Bear. and Comm.	2	6 ea.	10.15	6	2.75	3.40	1.65	1.02	36 for 6	2 men on the same.
Shaft	2⅛ x 21⅞	Fin. between Bear.	2	24	24	17.15	2.25	2.55	.42	.33	24.15	2 men on same.
"	6 x 42⅜	Centre and Rough Turn	2	28	29	20.30	2.25	2.57	3.15	2.26	49.15 for 2	4 men.
"		Key-Seating.	7	10	11.15	9	.70	.76	.10	.097	11 for 5	Slower boy.
Totals					2248.50	1364.05	$87.90	$107.87	$106.37	$76.25		

RESULTS OBTAINED BY THE PREMIUM PLAN.

RATIOS OF TOTALS.

New time per piece / Old time per piece = 1364/2248 = 61/100

New wages per piece / Old wages per piece = 76/106 = 72/100

New wages per day / Old wages per day = 108/88 = 123/100

NOTE.—As with the table published in our issue of March 9, 1899, the reduction of the costs to costs per piece reduces the apparent magnitude of the work. This reduction is not made in the case of the hours consumed, and the totals at the foot of the hour columns show the actual amount of work done. The ratio of the total wages per day will be seen to be not strictly correct, as no note is made of the *amounts* earned on the different jobs, *rates* only being compared. The ratio given is, however, substantially correct.

each individual drawing, but for each class of work, as the workmen do not figure by the drawing numbers, but by the work done.

Very accurate records have been kept for reference, and the system is completely inter-indexed, so that by knowing any one of the following all of the others can be found immediately; *i. e.*, the order number, the casting number, name of the part, the size, the man's number or name, the date of completion, the records of previous men on similar work, etc. In the matter of premium rates and payments, at the end of each two weeks a slip is made out for each man, showing exactly what he has been doing for the past two weeks, and he is paid thereby, receiving pay for one-third of the time saved at his regular rate.

The worst difficulty encountered so far has been that of having two men on the same premium job, and this we have found to a great extent unavoidable, running, as we are, with a full night force. In dividing a premium up in proportion to the time worked on it by each man, the poorest man receives the largest premium, and "the other man is always the poorest." Another difficulty in this same line is caused by not getting all the material for an order in at the same time. The foreman is often compelled to work up large stock orders in four or five installments, with different men each time, which mixes things up and spoils the work for premiums. The accompanying records, chosen at random from our standard lines of work, may be of some interest.

Brass Founding—Gates and Gating.

BY C. VICKERS.

The way to gate a mold is a point of the highest importance when casting any metal. Different metals, however, require different methods of gating; what may be suitable for one will not always produce good results with another. For instance, light bronze castings may be successfully run by a gate that would be entirely inadequate for yellow brass, while aluminum will require different treatment from either.

I will illustrate, as well as the limits of a short article will allow, a good method of dealing with the subject. Fig. 1 shows a common enough pattern in some brass foundries; it is called a "stem," and in size it may vary from 1 to 3 inches in diameter and from 12 to 24 inches in length. In appearance it is a plain enough job, but I have known it to cause a world of trouble to the uninitiated. It will "shrink" on the back, and when poured hot enough to avoid this trouble will come dirty.

In these remarks we will exclude all diameters less than 1½ inches, as those smaller than that rarely cause trouble. A molder making this job for the first time, unless in a shop used to the work, where he may be cautioned and advised in advance, will generally gate it on one end, using a small ordinary sprue, and he will find on shaking out that his work will be all shrunk, and of course lost. The next heat will then be probably poured hotter, and then it will almost invariably be found dirty.

Fig. 2 shows a good way to overcome these difficulties. *A* is the feeder and *B* the sprue or runner, which is connected with *A* by a tapering channel cut in the cope. At the point where this channel joins the riser *A* it is made very small, the object being to hold back the metal so that the sprue can be kept full all the time of pouring, in order that any dirt that may be held in suspension in the metal shall be prevented by its lighter specific gravity from entering the mold, as it will float on top of the head.

I have been taught by experience to gage the size of the feeder by the diameter of the casting. The feeder should exceed this a little, so that the casting will solidify first, thus giving the feeder a chance to perform the duty for which it is intended.

The gate connecting the feeder with the casting in this case is cut wholly in the cope, and is almost of the size of that part of the casting, being only so much smaller as will allow of a fillet, so that the gate can be broken off while the casting is hot without danger of "breaking in." The metal for pouring need not be very hot, provided the diameter of the feeder exceeds that of the casting.

Some brass molders do not believe in feeders, or risers, as they call them. Now, I do, although I never place them on top of a casting if they can be connected by a suitable gate, because a riser on top of a bronze casting generally leaves some defect under it when cut off; and the same holds good of aluminum, only that this metal requires much more feeding than bronze, in order to ensure solidity.

For example: Fig. 3 shows a pattern. It is a square box, the corners of which are strengthened externally by circular pillars of solid metal. The comparatively heavy hub in the center is strengthened by being connected with the body of the box by brackets as shown. Now, as the walls of this box are only ¼ inch in thickness, unless we make provision for feeding the hub by means of risers, it will be unsound, as there is no metal available to supply the shrinkage. If we are casting these in bronze it is possible to obtain successful castings by molding the pattern with the hub down—that is, by coping out the inside of the box. As these were to be made of aluminum, the molder received instructions to mold them in a three-part flask, with the hub upwards, and to place three heavy risers on top of the hub, connecting them as shown at *A*, Fig. 4, the risers to be placed as near the circumference of the hub as possible, and to be connected by heavy gates cut *on top* of the hub, as shown. When this advice was followed, the castings came out flawless. But Mr. Molder thought he could make them better two-parted and hub down. He took off a riser from each of the four corners; result, he lost every one, the hub being scarred by deep shrinkage seams where it joined the body of the box. This example is given to show how much more feeding is required by aluminum than by bronze. Cast in bronze, hub upwards, as illustrated, one riser would have been sufficient to secure satisfactory results. But to return to bronze: I once knew a molder who claimed to be good on heavy work; he was given a tester. The foreman had sized his man up pretty correctly, and expected him to "fall down"; and he did. He gave him a very plain job, just a ring about 10 inches in diameter and 4 inches in thickness. The molder thought he had a snap. He used a 2½-inch cope and a sprue an inch in diameter and connected this with a very heavy gate to the casting. He pierced his cope with a lot of holes by threading through a thin vent wire, and he felt like a man who had done his duty, and done it well. The mold was duly poured, and ultimately the caricature of a casting was on exhibition. It was a beautiful piece of work—of its kind. The upper part resembled the surface of the earth, and from the same cause, contraction in cooling. The upper surface was covered with little hills, these being formed by the metal rising into those vent holes and solidifying. If such a casting is to come out true to the pattern, it must be fed with metal, to make good the loss in bulk by shrinkage, from some source outside of itself, and this is a law there is no evading.

I won't say the proper, but a good way to make such a casting is to put on a feeder, 3 inches in diameter and at least 5 inches in hight, connected to the casting by a gate, say, 1½ inches in depth by 1¼ inches in width. Such a feeder if used as a sprue will be apt to produce a dirty casting, so it is policy to use an extra sprue, connected either with the feeder or running into the casting direct. Whichever way is adopted, the sprue should not be more than an inch in diameter and the gate very small, so as to enable the head to be kept full during pouring. It is a common notion among molders that brass castings require a very heavy gate; experience has shown me that this is a fallacy, a small gate enabling the head to be kept full when pouring, and suitably placed risers, to provide against shrinkage of the heavy parts, are the things to be desired for brass.

Take a brick, for instance, a common enough job to look at; but if we wish a nice, clean, perfectly straight casting in either bronze or aluminum, we must pay especial attention to our feeder and the way we provide for the entrance of the metal into the mold. There are several good ways of making this job. We can

place gate and riser at opposite ends or at the same end, and connect as in the case of the crosshead aforementioned, or we can incline the mold 1 inch (that is, place an inch block under the front), have both gate and riser at the highest point, using a riser 3 inches in diameter and 4 inches in hight, and instead of cutting the gate into the riser or directly into the casting, so that the metal will roll down the inclined mold, run a small channel from the sprue down to the lowest point of the mold and cut a small gate. The metal then enters at the lowest end, fills that and gradually and gently advances up the incline, until the cavity is filled, and then into the riser, carrying there any of the dirt that it may have gathered.

Another example is shown at Fig. 5. It is an arched plate, called a saddle, and is not a fictitious illustration. Right across the center runs a heavy rib, 2½ inches high by 2 inches in width. The plate is not a difficult thing to run; the rib is the thing that is likely to cause trouble by shrinking. The molder that made this job simply took no notice of the rib; he knew a 2½-inch riser would take care of that, so he molded his plate rib uppermost, cut a small spray gate to one end of plate, planted his riser at one end of the rib, connecting it with a good-sized gate, poured tolerably cool, and the job when cast was a work of art.

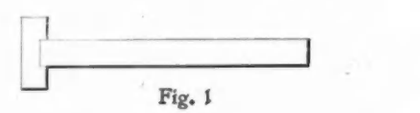


Fig. 1

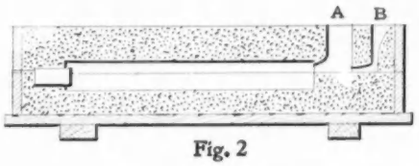


Fig. 2

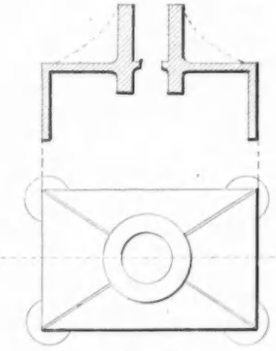


Fig. 3

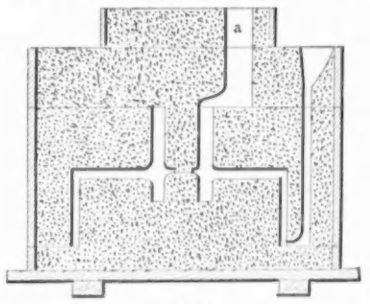


Fig. 4

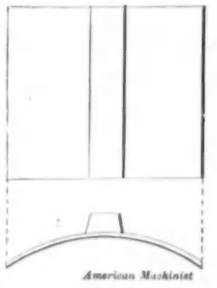


Fig. 5

GATING FOR BRASS CASTINGS.

Legal Notes—Scope of Employment—Warning Under General or Specific Instructions.

BY WM. MARSTON SEABURY.

Samuel E. Evans, who was injured while in the employ of Edmund P. Ervin, brought suit against his employer in the Circuit Court of Johnson County, Indiana to recover damages for his injuries.

He alleged that he was employed in the defendant's mill to operate the machinery and to work upon certain articles manufactured by the defendant; that upon the day of the accident he was instructed by the defendant to tear down a large shaft, remove one of the pulleys, adjust the two remaining pulleys and replace the shaft upon the hangers. He removed one of the pulleys, and while attempting to replace the shaft it became unmanageable and fell, injuring his hand. The plaintiff's suit was brought upon the theory that he was injured while doing work under instruction from the defendant which he had not been engaged to do.

It appeared that the plaintiff was a carpenter by trade, and in connection with this trade had operated machinery and had worked in a planing mill before he was employed by defendant.

The jury brought in a verdict for the plaintiff, but found as a fact that the plaintiff was injured while doing work which was within the scope of his duty. Judgment was rendered for the plaintiff upon the verdict of the jury, from which the defendant appealed. The Appellate Court held that as the finding by the jury to the effect that the plaintiff was injured while doing work which he was engaged to do was in irreconcilable conflict with a general verdict in favor of the plaintiff, the judgment should be reversed. (56 N. E. R., 725.)

WARNING UNDER GENERAL OR SPECIFIC INSTRUCTIONS.

Some time ago E. N. Martineau was injured while in the employ of the National Blank Book Company. He was not a machinist by trade and he was not employed to do machinists' work, but he had considerable mechanical skill and had on some occasions repaired machinery.

On one occasion he was requested to repair a machine which it was not his duty to manipulate, but with which he was somewhat familiar. The machine contained a gear wheel, to which was fastened a "clip," which, by engaging with a "dog," formed a device used in starting and stopping the machine. The power was transmitted by a belt, which, when the machine was not in operation, was shifted to a loose pulley, but which, unknown to Martineau, had a tendency to creep back to the tight pulley. While he was at the right-hand end of the machine at work and his right hand on the inner face of the wheel, the machine suddenly started, the clamp went down, the geared wheel revolved and caught his right arm between the inner edges of the rim and spoke of the wheel and perpendicular rods. To recover damages for this injury Martineau brought suit against the National Blank Book Company in the Superior Court of Massachusetts, Hampden County. The evidence was conflicting as to whether the plaintiff was told to see what the matter with the machine was and to fix it or, as testified to by him, merely to "fix the dog and clip."

Judgment was rendered for the plaintiff in the trial court, and the defendant appealed to the Supreme Judicial Court of Massachusetts upon various and numerous exceptions taken at the trial.

In overruling the defendant's exceptions and sustaining the judgment of the trial court, the Appellate Court, Mr. Justice Barker rendering the opinion, said: "Assuming that if the plaintiff was asked generally to examine the machine and to repair it if he could, the defendant was not at fault as to the plaintiff by reason of any defect or danger connected with the whole apparatus, yet if the plaintiff was asked only to repair a specific part of the mechanism, it might be the defendant's duty to warn him of the danger, not apparent and due to the improper working of some part of the apparatus distinct from that he was asked to repair—as, for instance, the creeping of the belt from the loose to the tight pulley. These considerations require us to overrule the exceptions." (43 N. E. R., 513.)

The Simplon tunnel will be 12.26 miles long when completed, and of this 3 miles have been driven in a little more than 18 months. Five and a half years were originally estimated as the time required for completion, and a penalty or bonus of $1,000 per day for delay or acceleration of the work, as the case may be, is included in the contract. Instead of a single double track, the enterprise is to consist of two parallel single-track tunnels.

A Diagram for Solving Compressed Air Problems.

BY J. A. BROWN.

Having shown some of the simpler applications of logarithmic cross-section paper* it is now proposed to follow this by showing, as an example, the construction and use of a diagram for solving all the usual problems occurring in calculations relating to air compression for which the ease with which fractional exponents are handled makes it especially suitable. The diagram given in Fig. 1 offers a rapid solution of many of the questions arising in that line of work. Among other things, it is often desirable to draw the isothermal curve and the adiabatic curve upon actual compressor cards; to find the index of the actual compression curve; to know the relations between volumes, pressures and temperatures of air compressed adiabatically. The theoretical mean effective pressure and the horse-power necessary to compress a given quantity of air may also be required.

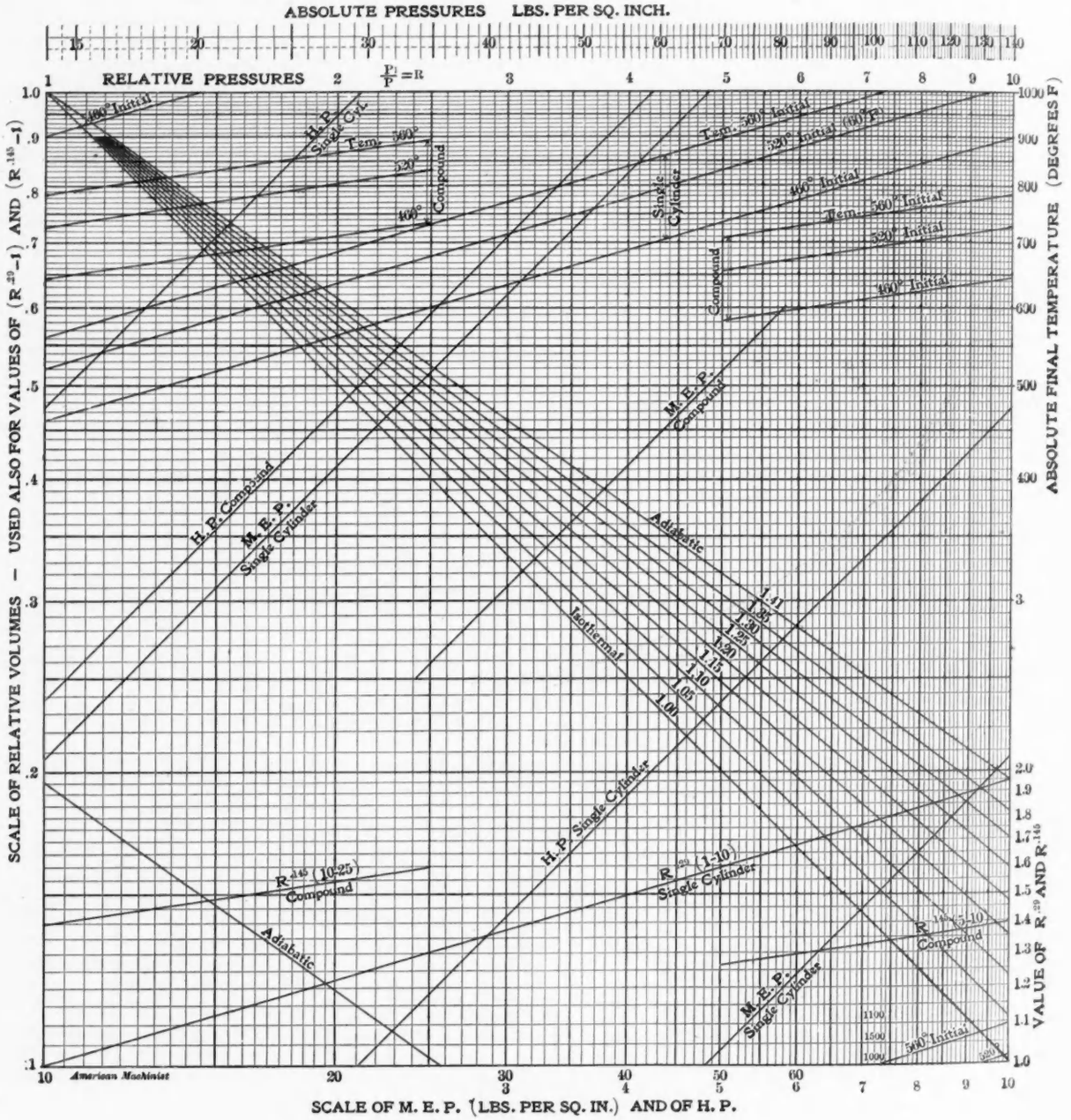


FIG. 1. DIAGRAM FOR SOLVING COMPRESSED AIR PROBLEMS.

In Fig. 1 the upper horizontal scale is the one of relative pressures and is figured from 1 to 10. The left-hand vertical scale is the one of corresponding volumes, and is figured from .1 to 1. The simplest relation between pressure and volume is when air is compressed isothermally, and it is represented by $P\,V = P_1\,V_1$. On the diagram a diagonal drawn from the upper left hand to the lower right-hand corner gives a table of reciprocals, and together with the properly marked vertical and horizontal scales, is an expression of the above formula. When air is compressed adiabatically the pressure rises faster than the volume diminishes, and the relation is expressed $P\,V^{1.41} = P_1\,V_1^{1.41}$. For any given pressure this increase in volume due to adiabatic compression may be represented in this way:

$$\frac{\text{Adiabatic volume}}{\text{Isothermal volume}} = \left(\frac{P_1}{P}\right)^{.29}$$

The ratio $\frac{P_1}{P}$ is usually represented by R. This ratio $R^{.29}$ also gives the final absolute temperature in terms of the absolute temperature before compression, and may be expressed:

*See The Properties and Uses of Logarithmic Cross Section Paper in last week's issue. This paper may be had of Keuffel & Esser, of this city.

$$\frac{\text{Final absolute temp.}}{\text{Initial absolute temp.}} = R^{.29}$$

or as usually expressed $T_1 = T\,(R)^{.29}$

The formula for mean effective pressure in its simplest form may be expressed:

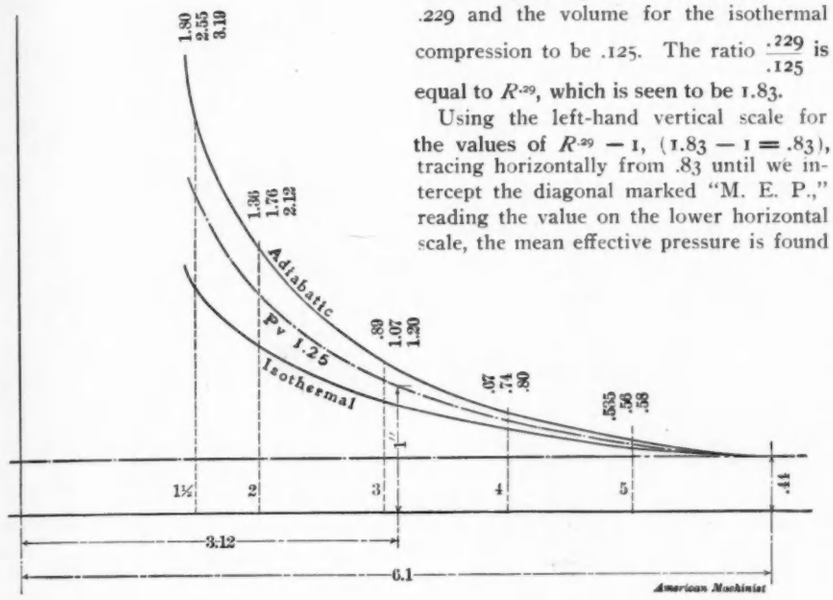


FIG. 2. COMPRESSED AIR INDICATOR CARD ANALYZED BY THE DIAGRAM FIG. 1.

scale of temperatures, the final absolute temperature is found to be 840°, 950° and 1,020° (the last value being read from the bottom).

Intersection with the adiabatic shows the corresponding volume (relative) to be .229 and the volume for the isothermal compression to be .125. The ratio $\frac{.229}{.125}$ is equal to $R^{.29}$, which is seen to be 1.83.

Using the left-hand vertical scale for the values of $R^{.29} - 1$, $(1.83 - 1 = .83)$, tracing horizontally from .83 until we intercept the diagonal marked "M. E. P.," reading the value on the lower horizontal scale, the mean effective pressure is found to be 40 pounds. The horse-power, from the intersection with the diagonal marked "H. P. single cylinder," and read on the lower horizontal scale, is found to be 17.5.

For compound compression $R^{.145}$ is found to be 1.35, $R^{.145} - 1 = 1.35 - 1 = .35$.

In the same way, from .35 on the left-hand vertical, reading from the intersections with the diagonals marked "M. E. P. compound" and "H. P. compound," the mean effective pressure is found to be 34 pounds, and the horse-power required, 14.7.

For two-stage compression the final temperature is considerably less, being, in the example chosen, 625°, 705° and 760° abs.

The diagram also offers a ready means of finding approximately the index of the actual compression curve. Take for example the card shown in Fig. 2. From the card measure V and P at two points, one at the beginning of compression where P measures .44 inch and V 6.1 inches. Take any other point, say $P = 1$ inch, and $V = 3.12$ inches. On the diagram* mark the intersection of .44 on the scale of pressures with 6.1 on the scale of volumes; mark the intersection of $P = 1$ and $V = 3.12$ in the same way. Draw a diagonal through the two points found and draw a parallel to it through the origin. The diagonal coincides with the index 1.25, which is the one required. If through the intersection of P and V at beginning of compression, diagonals parallel to the isothermal and adiabatic lines be drawn, intersections with these lines give corresponding values of V and P, and for every

$$MEP = 48.3\,(R^{.29} - 1)$$

and the formula for horse-power may be deduced from that, giving the work per stroke by substituting the volume of air drawn into the compressor. Say $V = 100$ cubic feet per minute for the volume of the cylinder, the formula then becomes:

$$HP = \frac{144 \times 100 \times 14 \times 3.45}{33{,}000}\,(R^{.29} - 1)$$

$$= 211\,(R^{.29} - 1)$$

For compound or two-stage compression under the most economical conditions the theoretical mean effective pressure may be expressed:

$$MEP = 96.7\,(R^{.145} - 1)$$

and for three-stage compression:

$$MEP = 145\,(R^{.0967} - 1)$$

The horse-power formula becomes, for compound compression:

$$HP = 422\,(R^{.145} - 1)$$

and for three-stage:

$$HP = 633\,(R^{.0967} - 1)$$

The values for compound compression up to $R = 25$ are shown on the diagram. The values for three-stage compression are not shown, but may be readily placed on the diagram by those interested in such pressures.

One or two illustrations will show the application of these formulas as shown by the diagram.

Take, say, 112 pounds absolute or relative pressure, $\frac{112}{14} = 8$. Following the vertical from 8 on the upper horizontal scale, we first cross the temperature diagonals. Here three values are given for the initial temperature, zero F., 60° F. and 100° F. Reading on the left-hand vertical scale or

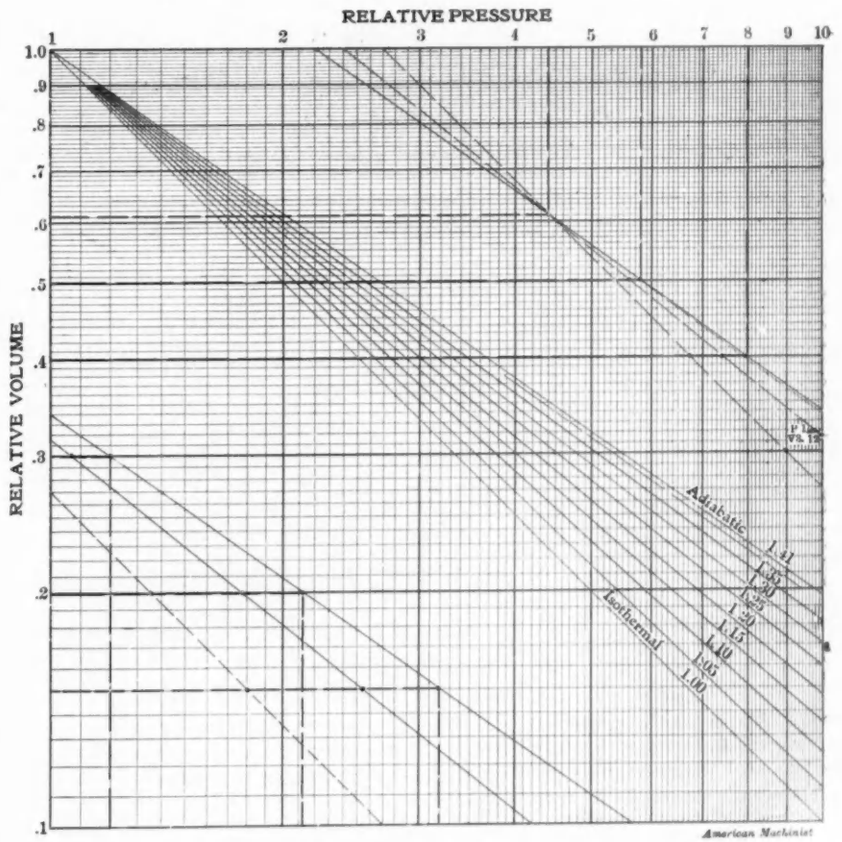


FIG. 3. APPLICATION OF FIG. 1 TO FINDING THE INDEX OF COMPRESSION CURVES.

* Partially reproduced in Fig. 3 to avoid defacing Fig. 1.

value of V the three values of P corresponding to P^1, or isothermal, $P^{1.41}$ adiabatic, and the P whose index follows the curve most closely, may be plotted directly on the card, as is shown in Fig. 2.

A Coining Press.

The accompanying half-tone, Fig. 1, shows one of a number of presses recently built for the United States Mint in Philadelphia by the Ferracute Machine Company, of Bridgeton, N. J., from designs of Mr. Oberlin Smith. It is intended for cutting blanks of gold, silver and other metals for the making of coin, these operations being performed at the rate of from 150 to 200 strokes per minute, with the dies cutting singly or in gangs, sometimes as high as three or four blanks at a stroke. This machine is the fourth size of a series of six sizes, known as E1, E2, E3, etc., and is noticeable for its great stiffness, the frame being built of heavy straight columns, set near together, and everything being of strong and massive construction.

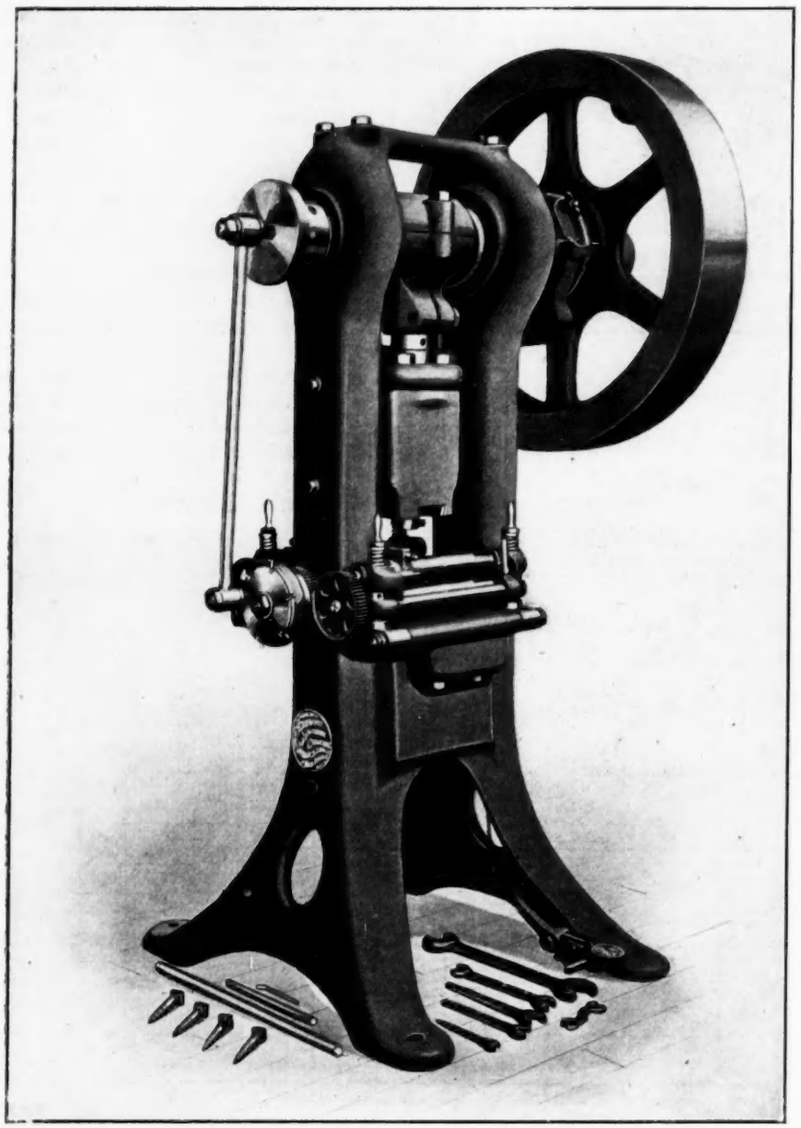


FIG. 1. A COINING PRESS.

It is equipped with a newly designed form of feed rolls, each pair of which, at the front and rear of the machine respectively, can be quickly swung outward and downward into the position shown in Fig. 2. The roller housings when swung upward are secured by the tightening of a beveled nut at each side into a countersink, two or three turns of the nuts in the opposite direction releasing them from the countersinks, which are set in the upper part of grooved slots, thus allowing the rolls to be swung outward, with the slots passing freely over the studs on which the nuts are mounted, without having to remove any bolts or nuts, as is usual in devices of this kind.

The central disk, which drives both sets of rolls is provided with six differential pawls. The ratchet which these pawls drive is cut with one tooth more than a multiple of six, thus causing each pawl in effect to revolve the ratchet but one-sixth of the pitch of a tooth. This, of course, gives the same result as if the teeth were six times as fine, which would obviously be impracticable, by reason of lack of durability and positiveness of action. By the construction described variations of feed as small as .02 inch can be obtained, and the total variation can be anything up to 3 inches, varying by steps of .02 inch.

The machine is equipped, as usual, with long slide bearings for ram, long ram adjustment, treadle-lock for continuous running, automatic stop clutch, etc. It also has a special brake-releasing device to enable it to be run at the unusually high speed before mentioned. A machine of this kind has been sent to one of the exhibits of the Ferracute Company at the Paris Exposition, being located in the United States Government Department, and shown running in connection with an approved coin miller and an automatic coining press.

An Automatic Lubricator.

The lubricator here shown is to be attached to any reciprocating or oscillating parts of engines or machinery requiring constant and reliable lubrication, as the crossheads, connecting rods, eccentric straps, etc., of engines, pumps, air compressors, etc. As it feeds grease instead of oil, it may be attached in any position desired, feeding vertically upward or downward, horizontally or at any angle desired. It feeds only when the part to which it is attached is in motion, and no feeding or loss can occur after the motion ceases.

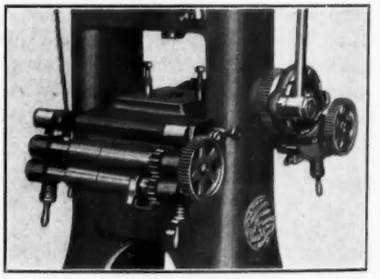


FIG. 2. SHOWING FEED ROLLS SWUNG DOWN.

The base of the lubricator is screwed firmly into the part to be lubricated in the usual way. The body is attached to the base by the union nut or enlarged ring at the bottom. When this is unscrewed the upper part is all taken off together, the barrel is filled with a charge of grease and returned and securely clamped in position again by the union nut. The feeding is accomplished by the pressure of the piston, and this pressure is applied by the vibrations of the pendulum seen in front. By the adjustment of the stop-screws at the side, the pawl attached to

the pendulum may be made to take from one to six or more teeth of the ratchet wheel for each vibration. On the ratchet wheel shaft is a worm which meshes into the large worm wheel on the top. The central screw or spindle is splined and revolves with this wheel at the same time that it travels downward by the operation of its thread in the central nut, which is screwed into the bracket or guide at the top. The feeding goes on, if the vibrations continue, until the piston reaches the bottom and the grease is all expelled. To raise the piston for refilling the barrel, the central nut, which has a milled and notched head, is unscrewed from the bracket, the piston is pulled up, the nut is whirled down the screw by hand and screwed tight in its place again. The ratchet wheel may be pulled around by hand until the slack is taken up and feed is fully established, and if at any time it is desirable to feed in an extra quantity of grease, this also may be done by turning the ratchet wheel. The lubricator may be made of any size and for any rate of feed desired. The one here shown will hold about 14 cubic inches, or somewhat less than half a pint, of grease. The ratchet wheel has 100 teeth, the spindle wheel has 125 teeth, the central spindle is 24 threads to the inch and the travel of the piston is 3½ inches. If, then, the pendulum is set to take two teeth of the ratchet wheel for each stroke, the number of strokes required to empty the barrel will be: $(100 \div 2) \times 125 \times 24 \times 3.5 = 525{,}000$, and at 200 strokes per minute this would last 2,625 minutes, or say 45 hours. Any of the usual kinds of grease may be used in the lubricator, and any percentage of pure graphite may be mixed with it. The worm is of steel, the pawls are of steel hardened and the wheels are of hard bronze. The lubricator was designed by G. U. Merrill, Paterson, N. J., and is made by J. L. Robertson & Sons, 204 Fulton street, New York.

AN AUTOMATIC LUBRICATOR.

Another Shop System.

BY A. L. GRAFFAM.

System is a valuable thing in the shop, of it is not too complicated. A shop system should be so plain as to practically explain itself to a new man, and should be adapted to the growth, removal or rearrangement of the plant without expensive changes. This article is not begun with the intension of describing in detail an elaborate shop system. My object is to present, as clearly and completely as possible, the *foundation* of a system, prepared with the foregoing ideas in view. It is composed almost entirely of parts selected from various systems, the ideas coming from such a variety of sources that I am unable to give credit for them. This system seems applicable to most shops, but in illustrating its application I shall consider the conditions existing in the one for which it was designed. The business included machine tool building, special machinery and jobbing. Special tools were planned with as wide a range of utility as possible, and sometimes the principal parts of a machine, such as the legs, bed and headstock castings of a lathe, would be made up into several styles by the addition of certain special features or attachments.

THE USE OF SYMBOLS.

To begin with, each article of manufacture is given a symbol, as AB, ZEB, etc., in alphabetical order, as follows: A, AA, AAA, AB, ABA, ABB, AC, ACA, ACB, ACC, etc., on towards ZZX, ZZY and ZZZ. By using the whole twenty-six letters in the alphabet, 6,526 symbols can be formed without using more than three letters in any one of them. Of course, it is understood that the symbols are for the sake of brevity in everyday use and to take the place of an alphabetical arrangement of the titles themselves. A list of these titles and the machines they represent (Fig. 1) will show exactly what they stand for and what symbol to allot to the next machine designed.

The next step is to go through the drawings and place within a ⅝-inch circle, close to the drawing of each piece, its number and the symbol of the machine, these piece numbers running from 1 up, on each machine. This enables a blueprint to be cut up, if desired, and a portion kept with its corresponding work, without the parts losing their identiy.

That ⅝-inch circle contains all the information a workman needs in charging his time. The patterns are marked with the symbol of the machine, the number of piece and its location when not in use; thus:

AD.
146.
20-6-2-3.

This third line is an abbreviation of ...

tion 20, shelf 6, second row, third division, as will be explained in another place. In practice the division would frequently be omitted. The material and core marks may be shown by different colors.

RECORD LISTS.

Fig. 2 shows the arrangement of a record for the parts of a machine—No. 3 16-inch turret lathe in this case. To economize space, the pieces have been renumbered and arranged to serve the purpose of illustration better. These Record List blanks can be printed on thin bond paper and kept on hand, from which blueprints may be made after they have been filled out. Keep blueprint duplicates of these Record Lists fastened together in sets for reference.

In the first column is the piece number. In the next is a small space for a sketch of the piece, if desired, followed by its name. Sometimes a sketch of this kind is the only means of making the name of a piece comprehensive, even to the regular workman. In ordering a new piece, the symbol and number are used—thus, AD No. 10—and by going to the AD Record List and running down the column to No. 10, we find that it is a stop-screw nut, on drawing No. 920, and if there are any on hand, they will be found in section 30, shelf 3, second row and first division, which is the front division of a drawer,

List of Symbols and Titles

Symbols	TITLE ON DRAWING	Remarks
A.	10" Speed Lathe	
AA.	20" Planer Centers.	
AAA.	20" Pattern Makers Lathe	
AB.	16" Engine Lathe	
ABA.	Jones' Double Sausage Machine	
ABB.	Jones' Single Sausage Machine.	
AC.	No. 2. Can Seamer	
ACA.	Bicycle Spoke Header.	
ACB.	No.3, Trimmer.	
ACC.	No. 7, Aut. Nut Tapper.	
AD.	No.3, 16" Turret Lathe	

American Machinist

Fig. 1

the stop-screws themselves probably occupying the second. Should it be necessary to make them, the drawing may be found at once by its number. But the drawing would not be needed in this instance, since the sketch of it on the Record List gives all the necessary information. Frequently, however, only an outline sketch (or none at all) without any dimensions, is given to show its general appearance.

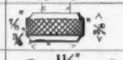
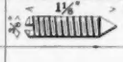
No. 9 is crossed off, and in the right-hand column, under Remarks, we find the reason. Note also the remarks relating to Nos. 7 and 8, which show that drawing No. 321 was made for another machine.

Manufacturers of bicycles, shoe machinery, etc., are frequently required to supply new parts for repairs, long after improvements have been made, and they must be exactly like the original pieces. In such cases it is advisable not to change even the slightest dimension on the drawing or Record List, after the piece has been used on a machine placed on the market. It seems the better way to cross it off like No. 4, Fig. 2, and mark it on the tracing; thus, "Not used after July 20,

Top of First Sheet

No. 3, lb-Inch Turret Lathe. Record List.

AD. 1

No. of Piece.	Description and Name.	No. of Pieces to each Machine.	Material	Patterns. Symbol, Number, and Location Marks on Patterns.	Patterns. No. of Pieces.	Patterns. Core Boxes.	Remarks.	No. of Drawing.	Location of Parts on Hand.	Weight. Lbs.	Weight. Oz.	Cost and Price. $	Cost and Price. ¢	Remarks.
1	Bed.	1	C.Iron	AB 1 40-1-3	10	3		740						
2	Legs.	2	C.Iron	AB 2 40-2-4	1			741						
3	Head Stock.	1	C.Iron	AB 3 40-3-2	4	2		742						
~~4~~	~~Turret Base.~~	1	C.Iron	AD 4 ~~40-1-3~~ 60-3-1	6	4		980						Not used after July 20 1897. See No. 1323.
5	Turret Slide.	1	C.Iron	AD 5 40-1-3	4			980						
6	Turret.	1	C.Iron	AD 6 40-1-4	2	2		980						
7	Tool-Post Collar (Top).	1	Mach. Steel					321	30-4-1					Same as AB # 80
8	Tool-Post Collar (Base).	1	Mach. Steel					321	30-4-1					Same as AB # 81
~~9~~	~~Feed Rod.~~	1	Cold Rolled Steel					920						Not used after Dec. 23-1898 Spline Lead Screw takes its Place
10	 Stop Screw Nut.	3	Mach. Steel					920	30-3-2-1					
11	 Gib Scerw.	5	Case Hard					920	10-3-3-2					Commercial Stock.
12														
1323	Turret Base	1	C.Iron	AD. 40-4-3				999						

Bottom of Last Sheet

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Fig. 2

1897. See No. 1323," and add the new style piece to the end of the list as an additional piece, making a new drawing also, with the changes embodied therein. In the event of a new pattern being advisable, the old one may be placed in the "Fossil Department," its place being taken by the new one and the proper change made on the Record List, as shown in the case of AD No. 4. Undoubtedly, where only a slight change is required, as a change in dimension, to cross the old figures and mark it "¾ after December 10, 1898," would be satisfactory in some shops. If the former method is practiced, the drawings and Record Lists show clearly what changes were made and when, and by the Final Records, to be described later, an accurate drawing of every individual piece in a machine previously sold may be found at once, if the number of that machine is known.

In the case of the first three pieces on the list, we find the patterns marked AB, showing that the bed, legs and headstock patterns of the regular 16-inch engine lathe are used.

The weight and cost columns are provided for the convenience of the shipping clerk, foremen, etc. Soda water may be used on regular blueprints, but pale-blue prints enabling the entries to be made with ordinary black ink or lead pencil, might be more convenient. This is very convenient for a foreman who wants to jot down the piece-work price, and it is a good plan also to have a space across the bottom of each sheet, about 1½ inches wide, for notes of this kind.

Assuming that all the parts of the machine and its special features and attachments show upon these Record Lists and pale-blue copies are bound together, the pen drawn through the names of the parts not wanted, and sent into the shop with orders to make a certain number of such machines, omitting all parts crossed off; what more explicit orders could be asked? The foundrymen can see at a glance where to find every pattern, the number of separate pieces it is composed of, and number of core boxes used with it; the machinists, every drawing and piece kept in stock. Different sets of prints from these lists could be made up and checked off, according to the different styles commonly built, and used over and over, and a telegram from a salesman giving the symbol and style of a machine would practically give a detailed drawing of every part.

TOOL AND STOCK RECEPTACLES.

In providing a place for things, first, decide upon a unit of size. It is a good plan to have this unit about 24 inches wide, 26 inches high and 4 feet long, so that a unit section will fit nicely under a section of the bench. This also admits of the sections being arranged one above the other against the wall, or back to back in rows through the stock-room, their tops forming a counter. In certain cases it would be advisable to reduce the width to 12 inches, but too much variety should not be permitted, and whatever the standard adopted, I would advise sticking to it wherever practicable. By width is meant the distance from front to back, and unless otherwise stated, all sizes given refer to outside measurements over all. Where a group of separate unit sections cannot be used, a size corresponding to two or more separate unit sections piled together can be substituted. Having the sections planned in this manner, reduces to a minimum the trouble and expense attending the growth, removal or rearrangement of the plant. Possibly the first cost would be a little more, but that is doubtful, as the sections would be built, a number at a time, from regular drawings. Be that as it may, it would pay in the end in most cases. The inside may be left plain or fitted with shelves, drawers, pigeon-holes, etc., as desired.

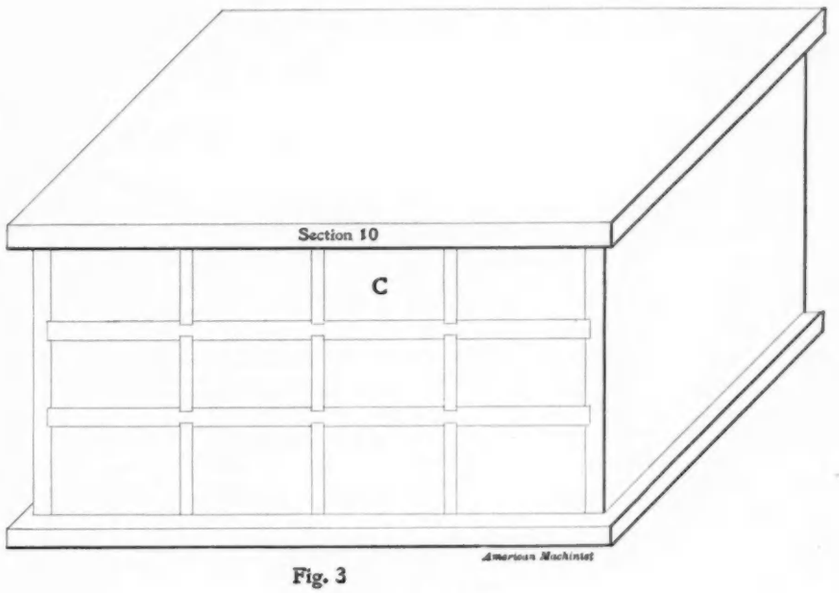


Fig. 3

A UNIT SIZE SECTION.

Each individual rack or case, whether large or small, is called a section. Now, let us suppose that Fig. 3 is section 10, unit size, and divided into 12 regular parts, with a drawer for machine screws in each. Then C would be section 10, shelf 3, and third row, and if there were two divisions in the drawer, the one at the back would be second division. This is the one designated in Fig. 2 as containing gib screws for No. 3 16-inch turret lathe, the brief form being AD No. 11, 10-3-3-2. Assuming that the same figure represents an openwork rack, 16 feet long, 78 inches high and 2 feet wide, for patterns, and marked "Section 40," this would be equal to 12 unit sections, and, according to Fig. 2, we should find the headstock pattern in C. The width can be doubled without destroying the uniformity, as three unit sections piled against the end would match it nicely.

TOOL LIST.

Now comes the most important feature in the system—the tool list. I call this the most important feature because there are so many shops where there is no system applied to anything except the tools. Consecutively arranged in the left-hand column on the Tool List are the numbers of the tools. The numbers in the class column are to facilitate picking out tools of a certain class, such as taps and hobbs, when it seems probable that new work may be planned so as to use any of those on hand. The meaning of these class numbers should be printed on the list. In most cases it would be advisable to tabulate such tools as hobbs on brief special lists.

Tools to be used in connection with another, have their numbers entered in the "Used With" column.

Under the heading "Made For" are two columns; in the left are the symbol of the machine and the piece number, or numbers, on which the tool is to be used; in the other is a description of the operation for which it was intended.

In the "Other Uses" column are entered the symbols and piece numbers of other machine parts on which they can be used, as fast as they are discovered. It often happens that some old tool gives out on a piece of work near the completion of a job, and it does not seem probable that there would ever be enough use for it in the future to pay for making a duplicate. Nevertheless, if all of its uses could be recalled, there would be no hesitation about renewing it. Again, a builder of experimental machinery sometimes has an offer for special tools used in some particular case, and by looking over the tool list he can see at a glance which ones are and which ones are not valuable for use on his regular work. These are some of the objects of the "Other Uses" column.

In marking the tools, I think it is desirable to put on the number of the tool a description of its use, symbol of machine and piece number, the place where it is kept and the date of making. These are all included in the marking of the drill jig No. 1, Fig. 4, which would appear thus:

No. 1.
For drilling bed for legs and legs for bed.
ABA 1 & 2.
Sec. 20-4-2-1.
Feb. 20, 1899.

The number is the only mark that is really necessary on a tool, as the Tool List is a key to all the information concerning it; yet it is best to designate its place whenever there is sufficient room.

cuse when one man obtains his check on a tool charged to a shopmate, as he could not produce the corresponding receipt check. As an additional precaution against mistakes of this kind, a label bearing the number of the tool represented by the check may be placed close to each check pin, as shown in Fig. 5. Out of a large crew, I have had several men come to me in a single day to ask what tools they had out, having loaned or lost them and forgotten what they were. Sometimes it would require an hour's search to find the checks, when it could have been done easily in five minutes with the double-check system, the receipt checks on the workman's ring directing attention to the exact spot for each. Another good feat-

of the machine represented. A very good form for the first page of a Final Record is illustrated in Fig. 6. The following pages would be simply a list of numbers representing every piece used in the construction of the machine, ending with one or two blank pages for entering the numbers of parts furnished in the future for changes or repairs, and memoranda relating to the same. These pages of numbers referring to the pieces used in the machine may be printed, without omissions, and in preparing the Final Record of any particular machine, cross off those numbers corresponding to such parts as did not actually enter into its construction. This plan is quite practicable, since the parts of the various kinds of machinery

Class			Class		
"	1	Jigs, Templates, Gauges.		7	Milling Cutters.
"	2	Taps.		8	
"	3	Hobbs.		9	
"	4	Reamers.		10	
"	5	Drills.			
"	6	Counterbores.			

TOOL LIST

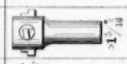
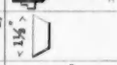
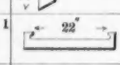
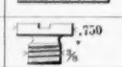
No. of Tool.	Class.	Description and Name.	Used With.	Made For. Mach. & No. of Piece.	Operation.	Other Uses.	Where Kept. Section	Shelf	Row	Division	Drawing and Order No's.	Remarks.
1	1	Drill Jig.		ABA. 1 & 2	For Drilling Bed for Legs and Legs for Bed.	ABB. 1 & 2.	20	4	2	1	630 716	
2		 Turret Tool. with Inserted Cutters.	151,47	ABA. 8	Used on F & S. 16 Turret Lathe for Making Packing Rings.	ABB. 8.	61	3	2	2	635 740	
3	7	 Milling Cutter. Right Hand. 60° Angle ¾" Tap	1091	AB. 44	Used on Becker M.M. for Rough Cuts on Compound Rest.	ACB. 6. General Use.	16	1	1	1		
4	1	 Gauge.		ABA. 3	For Gauging Length of Stay Rods over Shoulders.	ABB. 3.	17	3	1			
5		 Locating Stud.	460	ACA. 5	Used with False Jaw on Flat Jaw Chuck-(No. 460).		18	3	3	1		
6	6	Counter Bore. 1-½ Teat.		ACC. 6		General Use.	61	2	1		809	
7	5	Hobb.-Trip Thd. IV P. L. H. 1¾ Diam 1¾ Long ¾ Hole.		AB. 71		General Use.					810	

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Fig. 4

CHECK SYSTEM.

A complete double-check system is the best thing that I know of for the purpose, where articles are to be let out on checks, as tools usually are. That is, other checks of a distinctly different shape (which I will call receipt checks), one of which is marked with the number of the tool and its location, is kept on each check pin, to be given out with that tool as a sort of receipt for the workman's tool check. In this way every user of checks would have his original number of checks, of one or both kinds, upon his check ring at all times; the receipt checks representing the tools he has out, and enabling him to identify them wherever found in the shop. This leaves a tool-room attendant no exure of the double-check system is that the checks on a workman's check ring show just what tools are charged to him, enabling his account to be settled on short notice.

FINAL RECORDS.

At last we come to the Final Records. Every machine is stamped by the inspector with its number, preceded by "Record No.," to distinguish it from all other numbers on the machine, and to make its meaning unmistakable to the future purchaser. No two machines are given the same number, and the Final Record of each machine is numbered to correspond with its record number. This Final Record of a machine is filed away according to its number, and is essentially a brief history

built are numbered from 1 up, and with the exception that the numbers would run higher and require more pages in some cases than others, the lists would be much alike. But of course there would be cases where it would be better to have corrected lists prepared by the printer, and corresponding to the regular styles.

From what has been said in the foregoing, it is evident that the owner of a machine need only give the record number, and the builder is in a position to know exactly what every piece in his individual machine is like. That is, the builder goes at once to the Final Record, which shows the number of every piece used in the machine, and, by reference to the corresponding Record List, he is di-

rected to the original drawings, regardless of what changes may have been made in that type of machine.

FIRST STEPS IN APPLYING THE SYSTEM.

Time-keeping and the many other details that are really branches of a complete shop system have their proper place and fit harmoniously into this one, but these will be crowded into the future, to make room here for describing the manner of applying the foregoing.

It is one of the good features of this system that it can be put into use with so little confusion. Assuming that the chief draftsman is to apply it to your shop, his first step would be to prepare the list of symbols and titles. Then, securing a supply of blanks for the Record Lists, Tool Lists and Final Record Lists, he would go through the drawings of each machine, placing within a 5/8-inch circle, close to each piece, its number and the symbol of the machine, and making a record of the number and name of each piece upon the Record Lists, leaving any or all of the other data upon the Record Lists to be filled in whenever arrived at in the use or extension of the system.

When the list of symbols and titles has

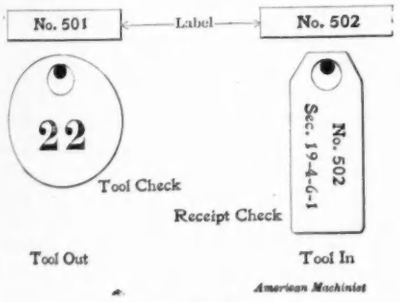


Fig. 5

DUPLICATE CHECK SYSTEM.

been completed and the pieces of each machine have all had their numbers and names entered on its Record List, the foundation of the whole system has been laid; and, starting from this point, its use may be applied to one or more branches, leaving its extension to other branches until such extension is desirable. Until after the foundation has been laid, the system is entirely disregarded, but after that there is no reason why the Final Record of the next machine built should not be made out by this system. This would not in any way affect the old system in other directions, and, if desired, the use of the new system may be confined to this one application; the same being true of its application to most other branches.

TOOL AND PATTERN BRANCHES.

Should the chief draftsman select the branch relating to the tools as the next one for the application of the system, he would have some of the sections constructed and then begin marking the tools, at the same time making the proper record on the Tool List and putting each tool in the place prepared for it, with the corresponding receipt check on the check pin close to each tool. One after another the sections would be filled and placed in position until the work of systematizing this branch is completed.

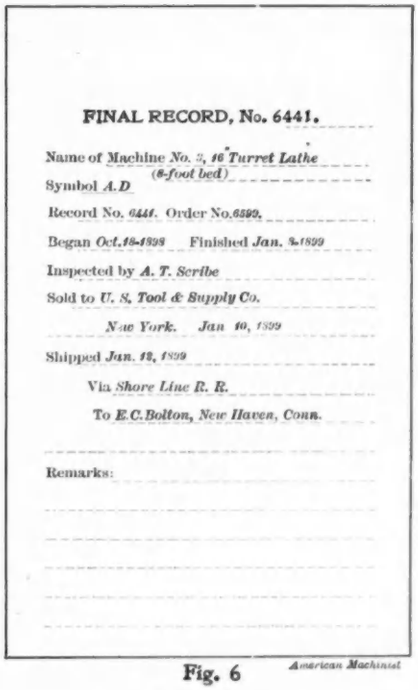
Directions for applying the system to the patterns would come so near being a repetition of what has just been said that they are unnecessary, as about the only difference would be, that the data concerning them would be entered on the Record Lists instead of a separate list.

Letters from Practical Men

Opportunities Don't Pull.

Editor American Machinist:

We often talk about the *secret* of success, and the phrase is probably more correct than some others that we use as glib-


FINAL RECORD, No. 6441.

Name of Machine *No. 3, 16" Turret Lathe (6-foot bed)*

Symbol *A.D*

Record No. *6441.* Order No. *6599.*

Began *Oct. 18-1898* Finished *Jan. 5-1899*

Inspected by *A. T. Scribe*

Sold to *U. S. Tool & Supply Co.*

New York. Jan 10, 1899

Shipped *Jan. 12, 1899*

Via *Shore Line R. R.*

To *E.C. Bolton, New Haven, Conn.*

Remarks:

American Machinist

Fig. 6

ly. Although it is not a rare thing in this country to see fellows getting along in the world, there is still something strange about the way in which it is done. It is so strange that some never catch on to it. Every fellow wants to get along in the world. He wants to be in a better position to-morrow than to-day. He wants to do more and better work for its own sake and to get better pay for his own sake. To do this he must first of all be qualified to do it; and we find that those who get along do, as far as they can, so qualify themselves in advance.

But after this qualification is attained, no matter to what degree, there are still two things that seem to be most essential to progress and success. These are the opportunity and the ability to recognize and seize the opportunity when it occurs. I can't help thinking that the latter is more essential than the former. I am led to think this more emphatically than ever from considering two or three letters asking for advice that have lately come to my notice. In one case a man in Philadelphia writes to know where there is a good city or town in which to start a brass foundry. What he wants, although that is not the way he puts it, is a place where there are lots of customers clamoring for brass castings and where there is no brass foundry within fifty miles. He won't find any such place in the United States. I honestly cannot suggest a better place for him to start his brass foundry than right in Philadelphia. There are certainly customers there; and that's what he is after. It is the yelling newsboy in the thickest of the crowd who sells the papers, and not the one that sits on the curb in a deserted side street crying for an opportunity. In another case a machinist—I am talking about actual cases—working steadily along at his trade in a shop on the Pacific Coast, writes and wants to know what place he had better come to in the East where he can get a better job, with, of course, opportunity for advancement. It would not have surprised me in the least if the same mail had brought also a letter from another machinist in the East asking approval of his notion of going to some Western jumping-off place to better himself. I could have honestly written to each of them to stay where he was, or at least on his own side of the continent; that the opportunities of the one were as good as those of the other, while each would have the advantage of some personal acquaintance and some familiarity with local customs.

The next case is still different. This fellow is located not far from the Mississippi. He has been working in machine shops two or three years. He has had some experience on the upright drill, milling machine, bench work and bench lathe, but he will never be satisfied until he gets on to an engine lathe, or at least on to a planer; can I tell him how to get on to one or the other? I certainly can't tell him that. I do know that fellows are getting on to those interesting tools. "It is difficult for an inexperienced hand to get a job on a lathe," but every fellow, however experienced now, was quite as inexperienced at the beginning. I can only say that our inquirer must get the job just as others have done and are doing. For his encouragement I can call his attention to our fourth fellow, whose case, it strikes me, is a much more difficult and discouraging one; but I expect he will get there after a while. This is a blacksmith's helper, located almost anywhere, who wants to get to the other side of the anvil. How does a blacksmith get a start? He has to waste a helper's time and try his patience hard at first. He must also waste coal and spoil iron and turn out poor work slowly, so that as a business proposition it

is hard to see how a blacksmith can ever get his chance. The case of a tool dresser is, of course, still worse, and yet there are excellent blacksmiths and expert and reliable tool dressers.

The opportunity for anyone is usually where he is, rather than where he is not, and it is not easy for me to believe that there is not some near opportunity of advantage, if perhaps a small one, for every one.

I do not advise anyone whose status is not above that of a journeyman to push to the large cities for employment, but there is one lesson of the large city that is good for anybody. Get into one of the most crowded streets and be one of the crowd. Study the crowd as a whole and then the movements of the individuals in it, your own included. You will find that there is an average or uniform rate of movement for the mass, and you will find that it is quite easy to move along at this speed. If you happen to want to move along faster you will find that it requires some special effort to do so, but you cannot deny that there are continually openings for you to take advantage of, if you will watch for your chances and take them. You will find also that some get along much faster than others, although it can hardly be said that all have not the same average opportunities in such a case. Those get along the fastest who are most determined to do so, and who are the most persistently alert. The openings in the crowd do not pull or suck you along, as some seem to think is the function of opportunity, but you drive yourself into the opening, and from one to another, and that is all that I know about getting along in the world. Probably every fellow could say, as I can, that if he had more push he could push himself faster and farther.

TECUMSEH SWIFT.

Spiral Gears.

Editor American Machinist:

I hardly think that your correspondent, Mr. Ernest J. Lees, solves the very simple problem referred to in his letter published in the "American Machinist," No. 18, in the simplest and most direct manner. I should prefer to proceed thus, using the result given at the bottom of the first column of page 348 of your issue No. 15:

$$\text{Cot. } \alpha = \frac{D}{rd} = \tfrac{1}{2} = .50000 = \text{cot. } 63^\circ\ 26'$$

Of course, graphical methods should not be followed when calculation of a simple kind is available. It should be noted, however, that the particular problem referred to is not one which would occur in designing screw gears, information as to the angle being required prior to the exact determination of the diameter of a gear. As to the particular information which the article on spiral gears in your issue No. 15 was intended to convey, it may be useful to some who are unable or unwilling to face the solution by the use of trigonometrical methods given in Mr. De Leeuw's article in issue No. 2.

It should be noted that whenever possible the angle between the teeth and the axis of spiral wheels should be as nearly as possible 45°, the angle of maximum efficiency being somewhat near that figure—see Mr. Halsey's article Jan. 13 and 20, 1898, on "Modern Practice with Worm Gearing." In that case the wheels for gas engines would not be the same size, but the teeth would be inclined at the same angle. ROBERT A. BRUCE.

New Brompton, England.

Crank Shafts for Large Engines.

Editor American Machinist:

In the "American Machinist," No. 19, Mr. Booth takes exception to my criticism of his article on "Crank Shafts for Large Engines." He does not deny that my position is correct, but claims that in saying that he was discussing only large engines he took care of the factors I claimed he omitted, and that it was therefore unnecessary to go into such details as rubbing speeds, etc.

My contention, in brief, was as follows: First, that work dissipated per square inch of the bearing, and not pressure per square inch, creates heat and wear; second, that the ratio between heat to be dissipated and area of the radiating parts of the bearing determines the *temperature* of the bearing; and third, that the heat dissipated depends upon the work lost in the bearing, and that in determining the work lost the speed of rubbing is *just* as important as the pressure per square inch, and that the two quantities are practially inverse functions of each other.

If these claims be admitted (and it would seem that they tacitly are in Mr. Booth's article), it is in order to show that there is some definite proper rubbing speed for shafts of large engines; else there can be no definite proper pressure per square inch, for certainly if two quantities are inverse functions of each other, one cannot be more definitely fixed than the other.

It is neither claimed nor shown that there is any such admittedly proper rubbing speed, hence I cannot feel that specifying that only large engines were under discussion was sufficiently limiting to render my criticism needless. To take only one case—that over which this discussion started—two of the leading engine builders in the world, one English and the other American, advocated engine designs in which the rubbing speeds of the main shafts in their bearings were something like 360 feet and 630 feet, respectively—the number of revolutions per minute, work to be done, conditions of operation, etc., being exactly the same in both cases. My claim is that whatever pressure per square inch, say 130 pounds, is proper for 360 feet per minute rubbing speed, is too great in about the proportion of $\frac{630}{360}$ for a rubbing speed of 630 feet, if the same work is to be done per square inch of the bearing, and that the same limits of heating and wear maintained in both cases.

That this claim, the theoretical reasons for which I have tried to give in part, is borne out by experience will be shown by an examination of the designs of large American engines for driving dynamos, in which much lighter pressures per square inch are used in the bearings, where the rubbing speeds are relatively high, than in marine engines, where the rubbing speeds are lower.

As to Mr. Booth's claim that a water-cooled bearing is sure evidence of an insufficient bearing I cannot at all agree, as it is to my mind apt to be quite the reverse. High *temperature* in a small bearing need, by no means, mean more *heat* lost than lower temperature in a larger bearing, but merely more heat lost per square inch of radiating surface. By supplying a great many more square inches of surface the temperature may be lowered, while the total heat dissipated is actually increased, which will be the case if the shaft diameter is increased. This is plainly shown by the "evil cycle" described in my previous letter, the correctness of which Mr. Booth fully admits.

It is scarcely necessary to say that the two journals I mentioned having rubbing speeds of 3 feet and 1,200 feet, respectively, were not in large engines. The point I was endeavoring to illustrate was that journals under high pressure might keep cool, and others under one-fortieth the pressure get hot, depending upon the rubbing speed—thus showing that the latter could not be ignored.

S. L. G. KNOX.

[We think this letter should close the discussion of this subject.—Ed.]

A Specimen of German "English"—Small Shop Management.

Editor American Machinist:

From time to time I have seen the recommendation in your columns that literature intended for consumption by "furriners" should be printed in their vernacular.

That this is necessary is realized by our German cousins, and I enclose herewith a specimen of English which will, no doubt, charm you as it has charmed others. I won't send you an explanation with it, because that would spoil the fun of guessing. I will say, however, that it is part of an instruction book for an embroidering machine, and while there are other delicious bits in it, this is the gem of the collection:

INSTRUCTIONS FOR "MOSS PUNCTURE."

1. Draw the machine out.

2. Place the handle and at same time the screw *v* towards *E I* viz. *v I* (see drawing).

3. Loosen the screw *a I* and elevate the *conic little wheel k,* till it *does not more card the little wheel k I.*

4. Turn the handle again towards the direction *E* (thus ½ turning) while the little wheel *k* is held fast.

5. Lower again the little wheel *k* till it does *again card* the little wheel *k I* (but not too low).

6. Fasten the screw *a I.*

7. Loosen the screw *j* at the handle and turn the system of tubes towards the opposite direction, while the handle is held fast towards *E.*

8. Fasten again the screw *j* at the handle.

9. Loosen the winged screw *v* and turn the *needle-stake* ½ time, so that the needle-opening comes to stand *vis-a-vis the winged screw.*

10. In taking away the *sting plate,* it will be perceived that the small grasping hook instead of making its to-and-fro-movements departing from point *O I,* as at *chain-puncture,* now at the *moss-puncture* makes them departing from point *O,* but always only, when the handle is directed towards *E I.*

The "moss puncture" and the "sting plate," not forgetting the "conic little wheel"—aren't they delicious? Some of our German must be just as delicious.

I would like to see some articles on "shop management" of smaller shops. There are a great many problems for the small shop to solve, and the methods of the big shops furnish no solution. I mean the small shop that is just big enough to have troubles, but not big enough to have a fine organization—where one man has to do many things—where the question of *commercial* expediency turns up daily. I mean the shop employing from twenty-five to fifty hands and doing a variety of small work—sometimes a quantity of pieces, sometimes a limited number of special machines. Something a little beyond the jobbing machinists, but away behind the great sewing machine companies and small arms companies and typewriter concerns. I sometimes think the manager of such a shop has a tougher job than a man with ten times as big a shop. I appreciate very much the articles you publish about the large shops, but they seem so far away as to be "'eavenly" and one of those things that, for ordinary or "garden" machinists, can only be looked forward to as a kind of mechanical paradise. Perhaps, if you want me to, I might unburden myself a little more about my troubles.

S. M. ALLSHOP.

The "American Machinist" as an Identifier.

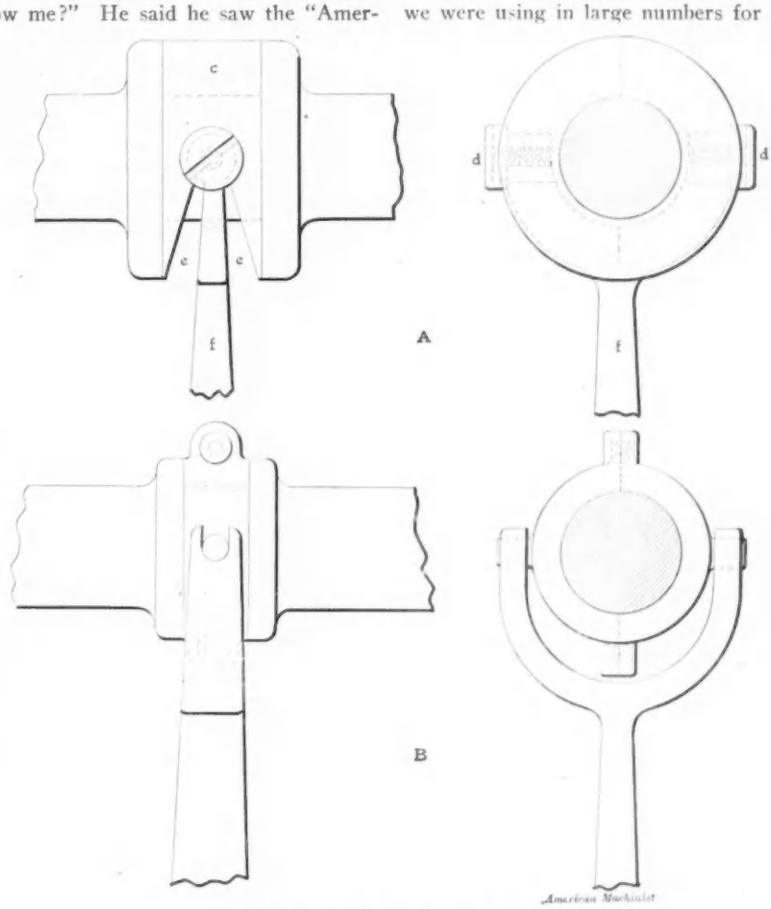
Editor American Machinist:

I recently had occasion to call at a city some forty miles from home, in answer to a telephone request, in reference to a special machine, to come, if possible, on the next train. I took a copy of the "American Machinist," which had just arrived, to read on the way. In due time I arrived at the city. In passing through the station with other passengers I was touched *—on the arm*—and a gentleman said to me, "Is this Mr. S., of P.?" I answered "yes." He said, "I have a carriage here to take you to the works." I was pleased, as I knew it was a long walk, though I had never been there. I was congratulating myself that I was known by those I knew not. But wait. After exhausting the condition of the weather, state of the roads, and other usual beginnings, in all of which we thoroughly agreed, I asked if I had ever met the gentleman before. He said he had no recollection of it. I then, naturally, asked, "How did you know me?" He said he saw the "American Machinist" sticking out of my pocket and took his chances. There was talent, and I passed the cigars that it might not be unrewarded. Your paper may some time prove a life preserver. It certainly adds to the pleasure of living, and as a passport has proved itself worthy. I would suggest the "American Machinist" in place of the "rabbit's foot." I got the order for the machine. S.

An Improved Collar for Clutch Shipper.

Editor American Machinist:

Here is rather an uncommon way of doing a common thing. We all know how soon a bronze collar wears out when it is used for shifting clutches, etc., similar to sketch *B.* Now if you make it similar to sketch *A* you will find it will outwear and give better satisfaction all through than the old arrangement. The collar *C* is made in halves, with holes drilled in each to suit round bosses on forked lever *f.* Screws *d* hold the half collars in place, and *e* is a clearance cut in the half collars *c* to provide for the movement of forked lever *f.* C. C. R.



IMPROVED CLUTCH SHIPPER COLLAR.

Dies for Switchboard Clips.

Editor American Machinist:

The set of dies which I am about to describe were for producing a clip, which we were using in large numbers for electrical switchboards. Fig. 3 shows the finished clip, with a 7-32 inch hole in the bottom to admit a screw for fastening on the board. The top of the clip was rounded on a 9-32 radius. The metal used was sheet copper, 1-16 inch thick, cut in strips 7-16 inch wide.

The first operation was to round off the ends, pierce the 7-32 inch hole and cut off the piece, which was done in the following manner, Fig. 1 showing the result. Fig. 4 shows the die *F* finished and worked out in the manner shown, hardened, drawn to a light straw color, ground, and the hole *U* lapped to size. *H H* are the gage-plates set so that the work will enter free-

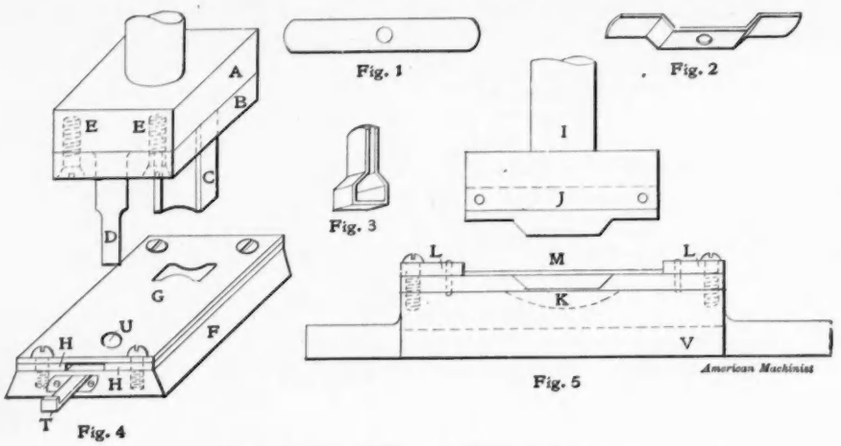


Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5

PUNCHING AND FORMING SWITCHBOARD CLIPS.

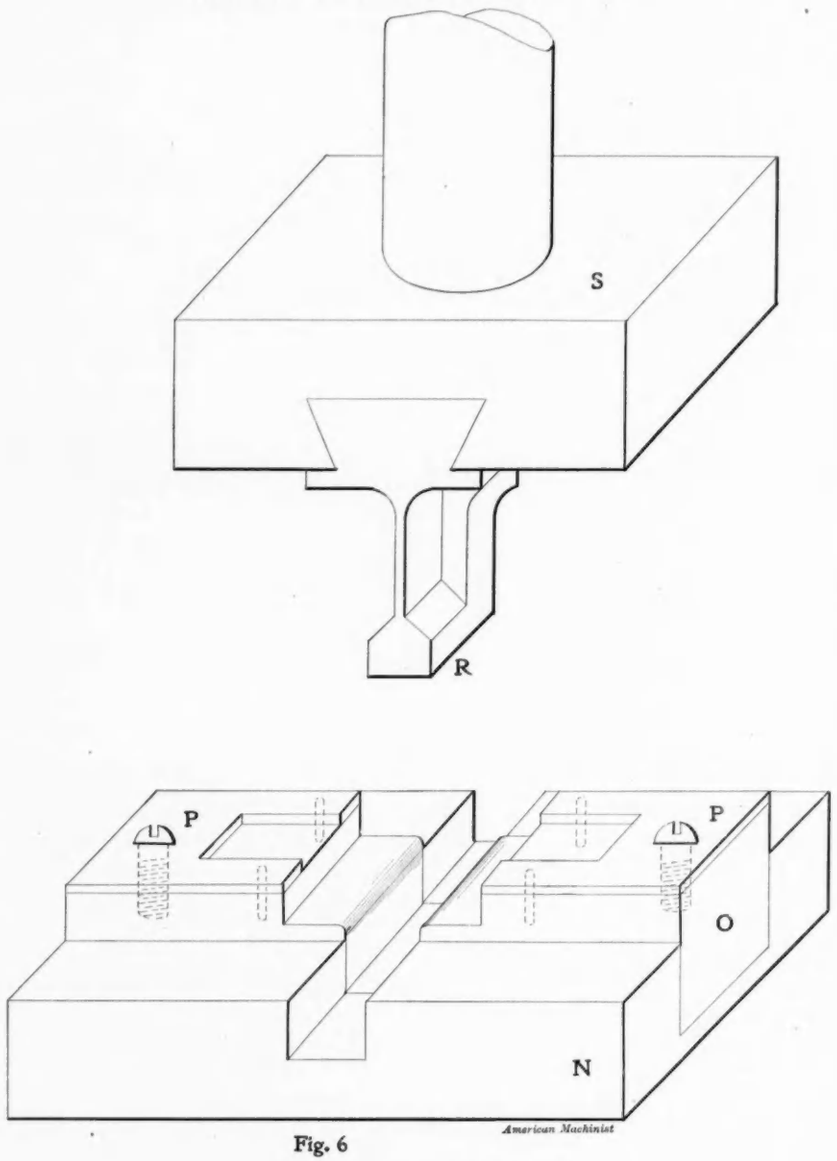


Fig. 6

DIE FOR THE BENDING OPERATION.

ly without side motion; *G* is the stripper, fastened with four screws as shown; *I* is the stop-piece of 1/8-inch flat cold-rolled steel, cut out and bent and fastened with two screws to the end of the die. *A* is the stem or punch-holder of cast iron, planed and faced, and a piece of flat machine steel B, finished to 7-16 inch thick, is fastened to it with four flat-head screws *E E*. *C*, the trimming and cutting-off punch, and *D*, the piercing punch, were worked out and finished, hardened and drawn from the back, leaving them a dark blue half-way up, and the back soft. They were then let through the pad *B* and upset or riveted as shown, thereby holding them fast and rigid. The pad was then fastened to the stem and the punch and die were ready for work. The die *F* was fastened in the regulation die block.

The copper strip, which was 20 feet long, was then inserted far enough to round off the end, and then pushed up against the stop *T;* and the punch descending, the hole *U* was pierced first and the back end of the first piece and the front end of the second piece rounded, thereby cutting off at the same time. The work was fed with the right hand and removed with the left.

The second operation, a partial bending, is done by a forming punch and die, shown in Fig. 5. *V*, the die-block, of cast iron, is finished and an opening planed to admit the die *K;* a piece of tool steel, 4½ inches long by ¾ inch square, worked out and finished to a template, hardened and drawn and driven into the die-block. *L L* are the gage-plates, doweled and fastened with two screws as shown. *I* is the stem of cast iron; *J* the punch of tool steel, hardened and drawn, and let into the holder and fastened with the taper pins. *M* shows the work in position before the operation, and the result is shown in Fig. 2.

The arrangement for the third and last operation, as shown in Fig. 6, consists of the die *O*, of tool steel, 4¼ inches long by ⅞ inch thick by 1 inch wide worked out so that the work, Fig. 2, will lie in it, resting on both ends within the gage-plates *P P* with clearance at the bottom. A groove, ½ inch wide by ⅜ inch deep, is milled through the center, the top edge rounded and the bottom corners left square. It is then hardened and driven into the die-block *N;* the gage-plate is fastened with dowel pins and screws as shown. The punch-holder is of cast iron, with a dovetail to allow the punch *R* to be driven in. This punch is of tool steel, worked out in the miller to template, leaving it ⅜ inch wide at the bottom, 1-16 inch wide up the center, rounding out at the top as shown, and a wall at the back 5-16 inch thick, left the full width of the stock in order to strengthen it as much as possible. All corners were left with a fillet to avoid cracking. It was then hardened all over, drawn to a dark blue, then driven home into the holder. The work, Fig. 2, was then placed in position, and the punch descending caused both ends to spring up and hug the punch, and continuing downward forcing it into the square groove with a good hard blow, drawing the corners nice and square. The finished piece, Fig. 3, was removed from the punch by hand, coming off quite easily, the punch itself being finished as smoothly as possible.

Jos. V. Woodworth.

Brooklyn N. Y.

Some Defects in Machine Tools.

Editor American Machinist:

A great deal is heard nowadays about the perfection of machine tools, and American tools in particular. It is true that they have reached a fair degree of perfection, but, at the same time, it is surprising that tool builders will put on the market tools in which there are glaring defects that, with little extra cost, could be completely eradicated.

Take, for example, vertical boring mills. You will find that not one in ten has the taper hole in the tool bar central with the face plate. This is a very great annoyance to the user, making it a difficult matter to fit boring bars in which to use double-end cutters. Such bars and cutters are very desirable for nearly all boring operations, and they must be absolutely central with the face plate of the mill.

There seems to have been no attempt made by the builders to overcome this defect; therefore, some method of fitting these bars must be adopted by the purchaser and user to insure their perfect alignment with the face plate. This can be accomplished by first fitting the bar to the taper hole in the tool bar, and after keying it in place, feeding it down past a tool bolted to the face plate, thus turning it absolutely true with the face plate and to any size desired. This is expensive, but cannot be avoided under the circumstances.

Lathe builders seem to have used all their ingenuity in building lathes for accomplishing fabulous results in the way of heavy cuts, scrape cuts, etc. Whether after the lathe is finished they lose interest in it or are mentally exhausted, no one can tell. Be that as it may, they evidently give no thought to the countershaft; at least, we seldom find a countershaft and pulleys anywhere near adequate for the work expected of them. For example, we have, for driving a heavy turret lathe, a countershaft 1 15-16 inches in diameter, on which there are three 16-inch pulleys, 4½ inches face. These are self-oiling, friction-clutch pulleys. They are, in fact, not only self-oiling, but oil everything in their vicinity. The belts are soaked in oil, the operator comes in for a good share, and the machine and floor are in constant need of cleaning. These pulleys should run 90, 120 and 130 revolutions respectively. The line shaft from which they are driven runs 200 revolutions per minute—about the usual speed for line shafting. How can it be expected to accomplish the work required of this tool with such a combination as the above? It is simply impossible; so we must surmount the difficulty as best we can, which means a new countershaft, at least 2 7-16 inches, with pulley not less than 24 inches in diameter and 4½-inch face. It looks as if the builder, after having built a good tool, concludes he has given enough for the money, and that anything will do for a countershaft.

It is a common thing to find the cone pulleys on lathe countershafts secured by set screws only. A 48-inch lathe with cone pulleys 5-inch face, 10, 14, 18, 22 and 24 inches in diameters, on a 2 3-16-inch shaft, and fastened by two 5/8-inch set screws, is enough to disgust anyone. Moreover, it compels the purchaser of such a lathe, if he has been foolish enough to put up and attempt to use such a shaft, to at once take it down and put in a good key. And when he comes to this he will find, no doubt, that the pulley has turned on the shaft and burred it up in such a way that a hydraulic press is necessary to remove it.

Another point of weakness in lathes is the cross feed on the carriage, which is always too light for the work.

We all appreciate the great improvement in machine tools, and hope it may not be long before we see the *perfect tool.*

B. W. T.

Some Lathe Criticisms.

Editor American Machinist:

I have been watching the articles on machine tools pretty closely lately. Some tell us of the failure of home-made machine tools and some tell of the shortcomings of the manufactured article. The trouble is that we have too much of both. Experience has pretty well shown that, generally, home-made tools don't pay. But, on the other hand, manufacturers are sometimes so careless about details, attachments, etc. They don't take enough of their own medicine. Those who do are generally the most successful. The shop in which I am employed lately bought a new lathe of a make which I suggested. It is made not more than a thousand miles from Cincinnati, and a fine tool, too; but it is short on detail. The T slot that holds the tool post is so wide that when a boring tool was put in and the screw put down tight it distorted the ring, so that in a very short time it had to be thrown away. A thicker ring of tool steel was made, which holds up good, but looks bad. This little defect might injure the sale of the machine if it fell among enemies.

That "bed-quilt scraping," so styled by some writers, covers a multitude of imperfections. There is a new lathe in this city built in the same place, but not by the same makers, on which the carriage does not touch the inside of the back way, and, my! how that lathe is scraped! I believe scraping is an injury in most cases.

Why is it that manufacturers of large lathes place the handle that operates the back gears in such a place that a man has to take a walk around the block to throw it in or out? Why not place it in front, at the base of the headstock? I saw an old lathe fixed up that way once, and you don't know what a saving in footwear it was.

I don't see why there should be a bushing for the centers of hollow spindle lathes. It is a nuisance in many ways, and in my mind unnecessary. There have to be two centers made anyhow, and one might as well be made larger to fit the spindle. It would be cheaper, too, as the bushing must be made of tool steel.

CHAS. A. ROGERS.

Des Moines, Iowa.

A Community Draftsman.

Editor American Machinist:

In spite of the fact that many lines of mechanical manufacture have been concentrated in the hands of large concerns, there are probably more small and medium sized shops more or less successfully pursuing the business of machine construction than there ever were before. Among the many difficult problems that these small shops have to solve is that of the designing of machines and a proper system of working drawings. To many of them it is unprofitable and impracticable to regularly employ an educated and experienced designer or draftsman. Yet in order to compete with the larger concerns, the small shop must work from drawings and by systems made and developed by highly skilled and experienced men. As in all other branches of machine production, the making of designs and drawings must be highly specialized, the work being subdivided and graded to suit the various skill of the men to whom the work is assigned. The single draftsman of the medium-sized shop cannot adapt himself with equal facility to the variety of work that comes to him. Besides being a constant charge upon the general expense account, he is a large part of his time doing work which could be accomplished at much less expense with proper facilities and subdivision of labor. And another large part of his time he is probably doing work that is practically valueless to his employer, due to the necessity of keeping him in the establishment against the time that his services are actually needed.

These circumstances are a constant source of expense and annoyance in shops where the wages of one or two draftsmen make an appreciable difference in the year's profits. With many others they are sufficient to cause the draftsman to be dispensed with altogether, or to prevent his ever being employed at all.

A plan by which a single corps of mechanical engineers, designers and draftsmen could furnish designs and working drawings and do the engineering work for a number of shops, would be a great benefit to the shops as well as a source of profit to a consulting engineering firm making a specialty of catering to the needs of small shops, in this respect. A shop proprietor could afford to pay a good price for a set of designs and drawings for any machine or line of machines he is building, because with him the expense would

then end. He would have at his command the highest technical knowledge and skill and the best facilities for doing the work, without any investment in drawing room and appliances, and without expense to himself except when he was actually having useful work done. He would also be able to know exactly his expenditure during the year for designs and drawings, and to limit that expense to a definite amount, if necessary.

An engineering office established to serve the needs of small shops could organize the work so as to facilitate its production and secure as profits the difference between the cost of work produced on a small and inefficient scale, and by a highly specialized system. To successfully handle such a business would require men of considerable breadth of engineering experience and with the best technical knowedge, but for those having the proper abilities and qualifications this seems to be a valuable unoccupied field for engineering talent.

W. L. MIGGETT.

Ann Arbor, Mich.

That Simple Pattern.

Editor American Machinist:

"That simple pattern" should be made to leave its own core. It should be turned of hard wood, mahogany or cherry, with the grain running lengthwise, or in the same direction as the hole through the center. This is the quickest, best and most durable way of making the pattern described by Mr. Willard in No. 18 of the "American Machinist." "HOBO."

Portugal's Machinery Trade.

Though not one of the great iron-consuming countries of Europe, Portugal merits more consideration from the American manufacturer than it has hitherto received.

The Portuguese Government has just published detailed statistics on the foreign trade of the kingdom for the year 1898. From these official returns we see that the total imports of the country increased from $50,886,700 in 1897 to $65,749,500 in 1898, while the exports increased from $39,712,000 in 1897 to $48,150,400 in 1898.

The imports of machinery, apparatus, implements and tools have steadily increased from 1894. In the latter year they amounted in value to $1,643,400, while in 1898 the value was $2,928,400.

Electricity is making slow but steady progress in Portugal. The country is rich in powerful rivers and waterfalls, and many installations are now either under way of construction or are contemplated. The importation of electrical machinery does not at present run into large figures, but it will increase steadily. In 1898 the value of such machinery imported was $54.226, of which $25,358 was of German origin, $14.185 of English, $8,487 of French, and only $2,686 of American origin. The rest was supplied by Belgium, Austria and Sweden.

Agricultural implements to the value of $9,409 were imported, of which $4,654 came from Great Britain and $2,763 from France. Our share was only $754. It must, however, be borne in mind that these figures refer only to small agricultural implements, as agricultural machines are included in the different items of general machinery. The latter items are arranged according to the weight, imported as follows:

Machinery of all kinds weighing not more than 50 kilograms—$23,750, chiefly from Germany, France, Great Britain and Switzerland. Only $278 from the United States.

Machinery weighing from 50 to 100 kilograms—$15,422, almost entirely from Germany, Great Britain and France. Smaller quantities from Belgium and Spain. Our share $280.

Machinery from 100 to 500 kilograms—$73,909, of which $26,000 from Germany, $22,000 from Great Britain, $16,000 from France, $3,000 from Switzerland, $3,000

(Continued on page 47.)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 22.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Dies & punches. Amer. Hdw. Co., Ottawa, Ill.

Grinder for sharpening punches and dies. Delivouk & George, Chicago.

Wanted—A small machine shop to buy or to rent. Address Box 133, AMER. MACH.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, Pa., build light machinery.

Selden Packing for Stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

Patents obtained; American, foreign; long experience; low charges. Edwin Guthrie, Registered Solicitor, Washington, D. C.

Wanted—Two No. 23 Brown & Sharpe plain milling machines; state price and condition. Fisher Typewriter Co., 40 Huron st., Cleveland, O.

For $50—Friction clutch pulley, steel rim, 54 in. diam., 10½ in. face, 2 7-16 in. bore; almost new; original cost, $114. Address postal to L. W. Pond Machine Co., Worcester, Mass.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wanted—Partner with capital; experienced mechanic desires correspondence with "broad gage" man willing to invest $5,000 or more to start profitable manufacturing business, where free site and free fuel are offered as inducements to locate. Address Box 114, AM. M.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Experienced general, all-around engine machinist wants position. Address R., AM. M.

Mechanical draftsman wants steady position; best references. Box 129, AM. MACH.

Mechanic wishes engagement, either with inventor or a foreman in small shop. Box 112, AMERICAN MACHINIST.

Situation wanted by experienced machine draftsman as tracer and detailer. Address Box 128, AMERICAN MACHINIST.

Here is a first-class die and tool maker, jigs, also good on experimental work; would like to take charge. B. W., AMER. MACHINIST.

A factory superintendent, technical machinist, 37, wishes to correspond with parties needing such a man. Box 99, AMER. MACH.

Practical designer and engineer, 29, desires position of responsibility with live company; best references. Box 126, AM. MACH.

Foundry foreman open for engagement; capable of introducing molding machines. Address Wm. H. Sickels, 254 Bond st., Elizabethport, N. J.

Young man familiar with the designing of tools, jigs, fixtures, automatic and stereotype machinery, would desire to change. Box 123, AMERICAN MACHINIST.

Foreman of broad experience and competent to design metal-working machinery, tools, jigs, etc., wants charge of a Western shop. Box 124, AMERICAN MACHINIST.

First-class monitor man, with 10 years' experience at designing of turret work and tool making for same, wishes to make a change. Box 125, AMERICAN MACHINIST.

An engineer-machinist, experienced in shop, erecting and operating modern steam plants, desires position in charge of manufacturing plant. Address E. M., AMER. MACHINIST.

Mechanical draftsman, designer, capable of managing, experienced on boilers, engines, machinery, wishes position in or near Philadelphia. Box 127, AMERICAN MACHINIST.

Position wanted by designer on light machinery and fixtures; capable of taking charge of drafting room; large experience; first-class references. Address Box 121, AMER. MACH.

Vise hand and draftsman wishes to make a change as foreman or as draftsman; have experience on engines and air compressors and general machinery. Address Box 122, AM. M.

Wanted—Situation as foreman machinist, by one having a broad experience with engines, governors, pumps, piping, dynamos and general repairing. "Indicator," care AM. M.

Designer automatic machinery, inventive ability, 8 years' experience intricate designing and supervising shop work, technical graduate '92, desires position to work up inventions or as head draftsman; N. Y. City preferred. Box 109, AMERICAN MACHINIST.

Position as traveling salesman; 15 years' experience; 6 years with present concern; would fit into any mechanical line; accustomed to closing large contracts; can earn salary or quit; salary $3,000 and expenses; can sell anything that's good; don't want to sell anything else. Box 120, AMER. MACH.

Help Wanted.

Wanted—Man familiar with automatic wire machine; competent to make the tools; fine work. Box 130, AMERICAN MACHINIST.

Draftsmen desiring extra money, state where employed, confidential. Edwin Guthrie, Corcoran Building, Washington, D. C.

Wanted—Draftsman, experienced in designing machinery. Address, with full particulars and references, Niagara Machine & Tool Works, Buffalo, N. Y.

Foundry foreman; one who can take charge of 150 men and produce results; state experience, salary wanted and age. Address "Ohio," care AMERICAN MACHINIST.

Master mechanic for rolling mill; must be a worker, able to handle men, sober and reliable, and thoroughly understand Corliss engines. "Rolling Mill," care AMER. MACH.

Wanted—Experienced mechanical draftsmen for a factory employing about 600 hands manufacturing electrical machinery; state experience. Box 119, AMER. MACH.

Wanted, at Once—Foreman of wide experience for machine shop producing large direct-current dynamos and motors; good salary for the proper person. Box 78, AMER. MACH.

Expert layer-out for boiler shop; one ac-

customed to laying out intricate work from blueprints. Address, giving age, experience and salary expected, L. O., care AM. MACH.

Wanted—A first-class Corliss Engine man; one who is familiar with the adjustment of Corliss gears and governors; technical man preferred; state experience. Box 75, AM. M.

Experienced draftsman wanted on mill machinery and machine tools; permanent employment assured to rapid and accurate draftsman. Bethlehem Steel Co., South Bethlehem, Pa.

Wanted, at Once—Foreman of wide experience for winding department of factory producing large direct-current dynamos and motors; good salary for the proper person. Box 79, AMERICAN MACHINIST.

Wanted—In Central New York town of about 10,000 inhabitants, several good floor hands in erecting room; state full experience, when you can begin work, and wages wanted. Box 116, AMERICAN MACHINIST.

Foreman toolmaker; New England shop employing 250 men, including 6 to 10 toolmakers; manufacturing engines and machinery; give experience, references and pay expected. Box 97, AMERICAN MACHINIST.

First-class mechanical draftsman wanted in New York City; must be familiar with light automatic machinery; good opening for good man. Address letters, stating particulars in full, to Box 131, AMERICAN MACHINIST.

Wanted—Man to take charge of die department, who is experienced in handling men and in the construction of sheet metal working dies, by a concern in large town in western New York. Address "Folsom," care AM. M.

In New York City, all-around machinist; must be A No. 1 mechanic, used to quite heavy work, and have highest references as to ability and character; state experience and pay expected. Box 132, AMER. MACHINIST.

Wanted—In a Philadelphia establishment, a thoroughly experienced designer and draftsman on heavy Corliss engines and flywheel pumping engines; state experience, age and expected salary. Address H. J., care AM. M.

We are enlarging our works, and will shortly require an increased number of skilled mechanics; we invite application from pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

Wanted—Wideawake, systematic young foreman patternmaker for shop employing 10 patternmakers; old-established work in central Ohio making heavy machinery. Address, stating age, experience, salary wanted, Box 108, AMERICAN MACHINIST.

Foreman boiler maker, by a shop employing about 150 men; man must have complete knowledge of all details, and be able to handle men to good advantage; good salary to right man. Give age, reference and salary expected to F. B. M., care AMER. MACHINIST.

We can use on heavy boring machines, planers and large lathes several first-class machinists who can and will make these machines do all they were designed to do; unless you can earn 30 or more cents per hour do not apply. Gates Iron Works, 650 Elston ave., Chicago.

Wanted—First-class toolmakers on small tool and model work for factory in western New England; permanent positions for first-class men; to receive consideration, applicants must state work most familiar with, place of last employment and wages expected. Reply Box 115, AMERICAN MACHINIST.

Wanted—Foreman for machine shop building steam pumps and ice machines; applicant must be a first-class mechanic, well up in modern machine-shop practice and know how to handle men. In replying give age, present position and mechanical experience; all answers confidential. Box 117, AM. M.

Wanted—An experienced machinist as foreman in a general repair shop; work mostly on engines and pumps, some new work, requiring thorough familiarity with modern tools and ability to devise special methods for expediting work; an excellent situation with good wages to an energetic man. Address F., P. O. Box 2,762, New York.

Wanted—Foreman for toolroom in machine shop located in Western Pennsylvania, employing 125 men on high-grade gas and steam-engine work; must be capable of designing jigs and tools for economical, rapid and accurate work, where all parts are made interchangeable; state age, experience and salary desired; references required. Address "Improvement," care AMERICAN MACHINIST.

Wanted—Foreman for machine shop near New York employing about 75 men making machinery of medium weight; must be familiar with modern practice, cost and piecework systems and be able to obtain the best results in quality and cost; also a capable draftsman wanted; to insure consideration applicants must give references, experience, age and wages expected. Address Box 118, AMERICAN MACHINIST.

Leonidas D. Angelopoulos,
INDUSTRIAL PRODUCE MERCHANT AND AGENT,
PIRAEUS, GREECE.
CORRESPONDENCE INVITED

SECOND-HAND
Boilers and Engines

One 75 H. P. Tubular Boiler 15 ft. long 52 in. diameter; also equipped with an Ohlstrum Stoker.
One second-hand 10 x 20 60 H.P. Cummer Engine.
One 54 H. P. Fairbanks, Morse & Co., Gasoline Engine.
One 25 H. P. Olds Gasoline Engine.
All in first-class condition, and for further particulars write
The Acme Machinery Co., CLEVELAND, OHIO.

Rawhide Pinions—Noiseless. And Rawhide Blanks.

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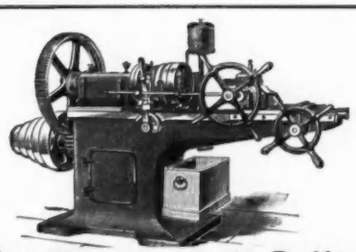
The Morgan Bolt Cutters
are unequaled for productive capacity and durability. They combine the lightest action with the greatest possible efficiency and economy. It will pay you to investigate.
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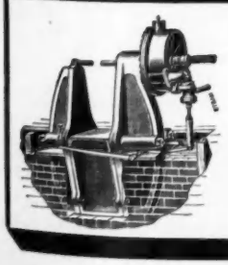
makes machines sightly and the polished parts brighter. Holds firm and easy to clean. Write for particulars.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If not equipped with air compressor **use Steam** direct.
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BETHLEHEM FOUNDRY & MACHINE COMPANY,
SOUTH BETHLEHEM, PA.

(*Continued from page 46.*)

from Spain, and $1,887 from the United States. The rest came from Belgium and Austria.

Machinery from 500 to 1,000 kilograms—$155,791, of which $116,000 from Great Britain, $15,358 from Germany, $13,652 from France, $3,000 from Australia, $2,000 from Belgium, and only $980 from the United States.

Machinery weighing more than 1,000 kilograms—$704,776, of which $422,200 from Great Britain, $152,130 from Germany, $95,701 from France, $82,130 from Switzerland, $17,782 from Spain, and only $8,909 from the United States.

Steam boilers were imported to the value of $45,401, of which $18,570 was from Great Britain, $17,200 from Switzerland, $4,796 from France, $3,400 from Germany, $1,300 from Italy; while our share amounted to the unimportant item of $135.

Air and hydraulic compressors and similar apparatus were imported to the value of $20,084, of which $13,926 from Great Britain and $3,355 from the United States.

The imports of separate parts of machinery amounted to $13,409, almost entirely from Great Britain.

Quite a lively demand exists for gas and water meters, the imports of which were valued at $8,762, entirely from France, Great Britain, Belgium and Germany, in the order named. Nothing came from the United States.

The imports of small hand tools, such as files and rasps, hammers, chisels, tongs—in short, all kinds of carpenters', blacksmiths', tinsmiths' and coopers' tools, amounted in value to $301,073. In this line of goods especially the United States should be able to make a better showing than it at present does. Only $11,793 of these tools came from the United States, while Great Britain's share amounted to $110,196, and that of Germany to $102,891. France supplied $53,587, and the rest came from Belgium, Spain, Italy, Switzerland and Austria.

Lithographical and typographical machinery is almost entirely of German origin. The imports amounted to $27,900, of which $716 was from Holland, $200 from France, $100 from the United States, $98 from Great Britain, $90 from Spain, and the rest from Germany. In connection with this we may mention that printing type was imported to the value of $10,620, of which $7,482 was from Germany, $2,153 from Spain, $590 from France, $343 from Great Britain, and only $52 was from the United States.

Scientific measuring instruments were imported to the value of $44,033, chiefly from Germany, France and Great Britain. Our share was $3,714. The imports of surgical instruments were valued at $7,489, almost entirely from Germany and France. Chemical apparatus was imported to the value of $5,752, to which we contributed only $177. The great bulk

came from France, Great Britain and Germany.

Steam, gas, and water engines, up to 30 horse-power, were imported to the value of $49,132, chiefly from Great Britain and Germany. Only $140 was from the United States. The imports of the same class of machinery from 30 to 100 horse-power were valued at $9,550, entirely from Great Britain, Belgium and Germany; from 100 horse-power upwards, $87,445, of which $54,030 was from Great Britain, $25,480 from Switzerland, and the rest from Belgium. Nothing was contributed from the United States.

The imports of bicycles were valued at $41,217, of which $16,202 was from France, $13,385 from Great Britain, $5,217 from Germany, and $5,375 from the United States. In this line, too, the United States makes a very disappointing showing, and much better might be done if the necessary attention was paid to the market.

Although the United States leads the world in sewing machines, our share in this trade is relatively very small, and shows an utter lack of systematic effort, as will be seen from the following figures: Total imports of sewing machines, $167,491, of which no less than $133,010 was from Great Britain, $32,588 from Germany, and only $1,403 from the United States.

From the foregoing figures it will be seen that Portugal is a market well worth our attention, and also that up to the present the American manufacturer has done no more than secure a foothold. England and Germany practically divide the trade between them. Their success is due to the fact that they have made the most strenuous efforts, and that they are represented by their agents in Lisbon and Oporto.

During the last year quite a number of new mining concessions were granted, which will doubtless result in a greatly increased demand for all kinds of mining machinery.

There is no likelihood of Portugal ever establishing machine industries of any importance, and therefore it may be assumed that the demand for machinery will be a steadily growing one. H. L. G.

New Catalogs.

The Betts Machine Company, Wilmington, Del., sends Catalog No. 10, describing its slotting machines of 8, 10, 12, 15, 18, 21 and 24 inches. It is illustrated with half-tones. Size, 6¾x10 inches.

Moseley Lathe Company, Elgin, Ill., sends a catalog of its No. 4 bench lathe and attachments, including those for thread and gear-cutting, milling and grinding, chucks, counter, etc. Size, 6x9¼ inches.

Manufacturers.

The National Lounge & Bed Spring Company, High Point, N. C., will build a new factory.

The Waterbury Clock Company will erect a

(*Continued on page* 49.)

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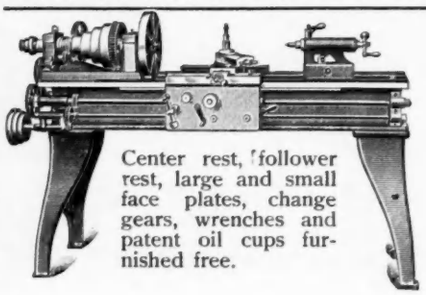

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